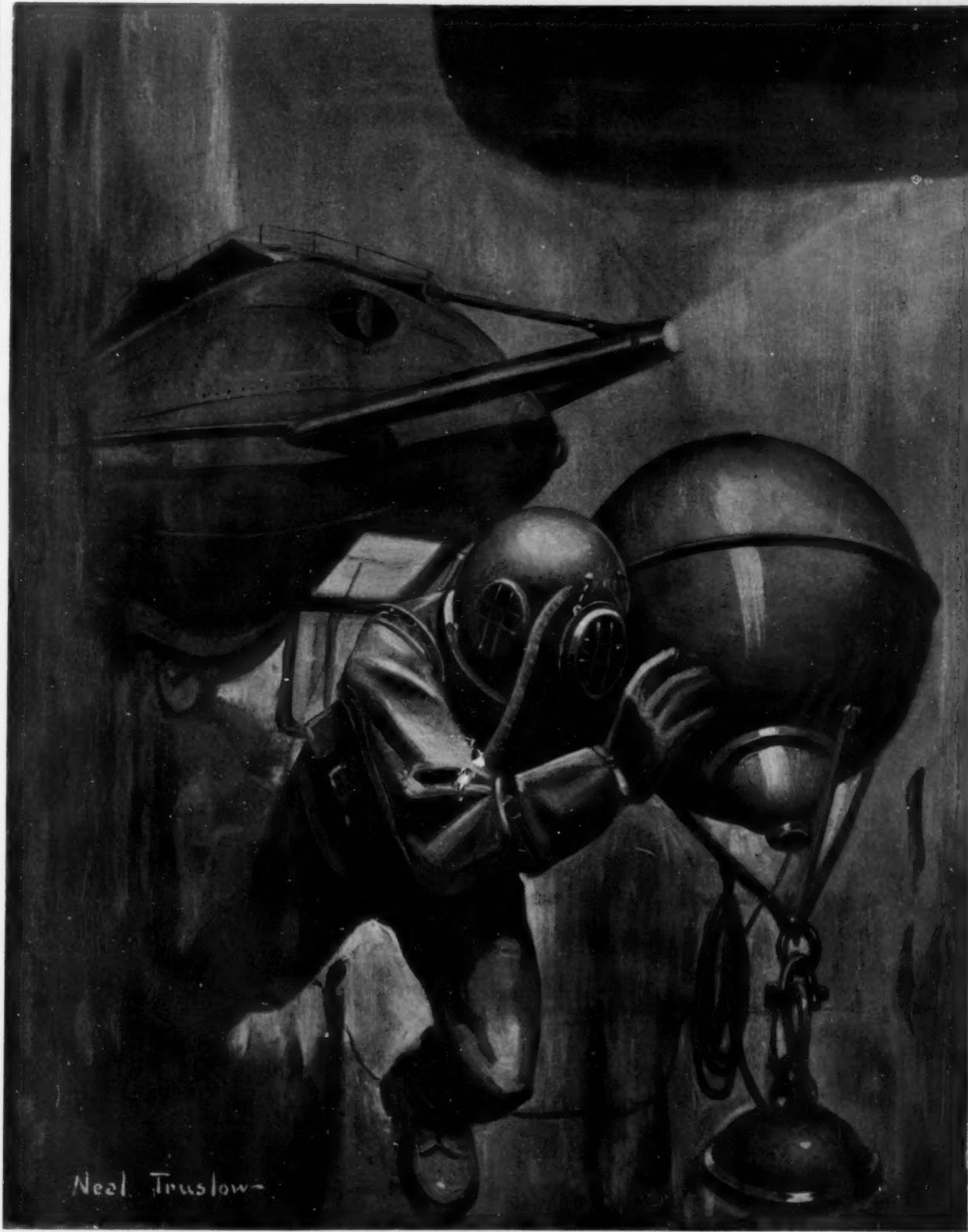


# SCIENTIFIC AMERICAN



Neal Trustlow

DIVER LEAVING A SUBMARINE TO PLANT A MINE.—[See page 68.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

## Unjust Criticism

We can boast of some fine achievements in the field of transportation in the United States, and among these the most remarkable, at least from the standpoint of safety, is the enormous number of passengers which have been carried year in and year out on the subway system of New York without any fatalities or even serious accidents. There is nothing in the whole world to compare with the record for safe travel over this underground system; as witness the fact that during the last nine years of its existence the subway carried over 2,000,000,000 passengers with the loss of but a single life—in fact, the first fatality in this time was the loss of one passenger in the recent short-circuit trouble to which so much attention has been given in the public press.

We have no wish to minimize the seriousness of the recent situation, when the burning out of the cables filled the subway with acrid smoke and subjected several hundred passengers to the danger of asphyxiation. It is undoubtedly true that it was largely owing to a conjunction of favorable circumstances that there was not a considerable loss of life. At the same time we feel that common justice calls for a protest against the unlimited criticism to which the operating company has been subjected because of this accident; and particularly we would protest against the endeavor which has been manifest in some quarters, to make political capital out of such an every-day occurrence as the short-circuiting of an electric cable—something which in the present state of the electrical art seems to be unavoidable.

Even in such a highly developed art as that of electrical transportation, evidently there yet remain certain lessons to be learned, certain improvements to be made. The obvious lesson of this accident is that the manholes in which the splices of the main cables are located should be absolutely walled off from the subway, so that, in the event of a short circuit, the resulting heat and smoke may escape to the outside atmosphere through gratings or other means at the street level.

The most that can be said, it seems to us, is that the construction used was an error of judgment; certainly, in view of the marvelous record for safe travel which the subway company has achieved, it is grossly unfair to make the charges of criminal carelessness and indifference which have been so freely bandied about in the public press and uttered by public officials. That no less than eight separate investigations into the matter should have been set on foot is ridiculous. The question of this accident and its proper remedy is purely a technical one; and the proper judges in this matter are the experts of the Public Service Commission and of the company which operates the subway.

The SCIENTIFIC AMERICAN holds no brief for the Interborough Company; in fact, during the earlier years of the operation of the subway, we were not sparing in criticism of certain features which we believed were faulty and called for drastic remedy. At the same time we cannot but feel that, in the matter of this recent accident, the press and much of the public seems to have lost entirely their sense of proportion. The fact

has been entirely overlooked that the one fatality which occurred took place after nine years of the fastest, the most congested and the safest transportation of vast bodies of people, under conditions which reflect the highest credit upon the skill and caution and vigilance of the operating company.

Having recognized these indisputable facts, let every means be taken to prevent any possible repetition of a similar disaster. It is desirable, where long stretches of subway occur on which there are no speedy exits to the street and no means of ridding the subway quickly of harmful gases, to provide, as early as possible, both means of ventilation and means of escape. Additional facilities should be provided to enable the trainmen, in the event of fire or other accident, to communicate at once by telephone with the fire and police departments and with the proper officials of the company. Incidentally, the accident has drawn attention to the advisability of the Fire Department's being equipped with an adequate supply of smoke helmets for use not merely in such contingencies as a fire in the subway, but in fires of any character which may occur throughout the city.

## Industrial Capitals as Factors in War

WHEN war was declared between Germany and France in 1870 the Parisians surged through the boulevards shouting "On to Berlin!" and in Berlin doubtless the cry was "On to Paris!" To-day, except from the pen of the newspaper writer, hard pressed for matter, no such talk is heard; for the day has passed when possession of an enemy's political capital was the decisive factor of the war. Probably, in spite of the rush of Von Kluck's army almost to the gates of Paris, the objective of the German army in the western theater of war was, first and last, the mobile field armies of the Allies. Once these were rolled up, captured, or dispersed and disorganized, the remainder of the German task in the subjugation of France would have been comparatively easy.

Similarly, in the eastern theater of war it is the breaking up, decimating, and surrounding and capturing of the Russian field army that is the objective of Von Hindenburg and his staff. Not only would the taking of Warsaw fail to end the war, but it would have only a temporary effect upon its fortunes. Nor would the capture of Moscow bring Russia to terms any more to-day than in the days of the great Napoleon.

The primary objective of the Allies, both of the French-British armies in France and Belgium and of the Russian hosts in Poland, is of course to achieve the annihilation of the German armies; but the conditions of modern warfare, with its admirable system of intelligence by aeroplane and spies and the wonderful mobility conferred by motor traction, has probably shut out from the councils of the general staff of the allied armies any expectations of the general capture or dispersion of the wonderfully efficient German army.

What, then, is the Allies' objective? If it is not Berlin, the political capital, at what particular point or points are Joffre, Kitchener, and Nicholas aiming with a view to bringing about a decisive conclusion?

To answer that question we must bear in mind how greatly the conditions have changed in Germany since the war of 1870. At that time Germany was an agricultural country which was witnessing the beginning of that industrial development which, in the succeeding forty years, has been the wonder and admiration of the whole world. In the interval the centers of resources and industry, particularly as related to a machine-made war, have been shifted, and they are to be found at opposite ends of the German Empire, namely, in the huge aggregations of mineral wealth and countless manufactories which are gathered in Essen and in the neighboring cities, and also in the rich mining district of Silesia. Should Silesia be overrun by Russia and should the allied French and British forces drive their way through into Rhenish Westphalia and take possession the war would be over. It would be over for the reason that the great sources of supply of the munitions of war and the means of transportation would be closed for the German army; and not all the acknowledged bravery and endurance of the German soldiers would avail if the great arsenals for the output of artillery and ammunition and the vast coal fields for the supply of fuel to the troop trains, to say nothing of the steel works from which come the steel parts for renewals of the military automobile service, were in the hands of the enemy.

So far, then, as the operations on land are concerned, the objective points of the Allies are Breslau and Silesia for Russia and Westphalia for the Franco-British armies. So varied have been the fortunes of war in Poland that it is impossible to make any prediction as to the course of events out there. In France and Belgium it looks as though a turning point had been reached, at which the German offensive was about to be transformed into a powerful defensive. To reach Essen the Allies must fight their way across an average distance of 250 miles of most strongly entrenched and,

as is certain to be the case, most bravely and bitterly defended country. Judging from the fighting qualities of the German troops and the exceedingly fine work of their war staff, it is not likely that the Allies, even in the event of a successful offensive, can obtain control of Westphalia before two and one half years of fiercely contested fighting have passed by.

## A Plea for Scientific Methods

SCIENCE is perhaps the most inhuman of all man's works. It would seem that man has given birth to a monster vaster than himself, which reaches upward into icy altitudes where he cannot live and stretches down to the unshakable granite of a certitude which lies deeper than all his hopes and desires. Perhaps there is something sinister about this monster. It has shattered man's simple pride and shattered his comfortable faith. And what are its compensations? For more than two thousand years have men groped after scientific knowledge, have spent laborious lives, ay, and suffered martyrdom, in the service of this most detached of all man's offspring. As a result we have achieved modern civilization, that haphazard conglomeration of flaming virtues and bestial vices, of a few men with power surpassing that of Cesar, with knowledge surpassing that of the old-time gods, and of millions who toil ceaselessly and hopelessly, driven by fear, with their priceless potentialities scotched from birth; the faintest adumbrations of what they might have been. And on the continent of Europe the very nations who have reached the topmost pinnacle of this scientific civilization are slaying one another in hosts greater than any known before in the history of the world.

Knowledge has not saved us; we are no better than our fathers. The old fierce instincts still rule, but nevertheless, if man is ever to achieve salvation, science must play the greater part. The very nature of man is a contradiction. Together with his recently acquired and comparatively weak desires for tolerance, charity and universal fellowship, are those barbaric old impulses, the legacy of innumerable brutal ages, which, after smoldering through many peaceful years, have now flamed out in mad destruction over more than half the world.

The brute in man took a long time in the making: these turbulent emotions have come down to us from very far ages; a few generations of noble thinking affect these old passions very little. We must have faith and patience. In the presence of this upheaval we are too prone to think that science has done nothing that really matters, nothing beyond adding to man's material comforts, building up a heartless civilization, and giving man greater powers of destruction than he ever wielded before. But, indeed, science has done more than that. Scientific knowledge is perhaps of little worth where the great things of life are concerned. Insensate hatred and bloody wars are evidently not avoided by learning that the earth is round, that air is a mixture of nitrogen and oxygen, or even that the universe may have four dimensions. But although the promulgation of scientific knowledge does not greatly alter a man, there is more hope in the promulgation of scientific method. A man who habitually thinks on the scientific method learns a fairness and restraint which is one of the most promising things in the later development of mankind. The hysterical outbursts of some scientific men over this war indicate merely that they keep water-tight compartments in their minds and that they fail to practise the scientific method consistently. The scientific method is very simple; it consists in believing no more than the facts warrant and in divesting one's self of national prejudice.

Whatever our sympathies may be, we often get a very hopeless feeling after reading some European writers. It is then that we realize the advantages of the scientific method. It might not be so free and picturesque as their own methods of thought, but it would at least prevent their writing so many pages of addled nonsense. How on earth can a man regard the whole German nation as made up of devils incarnate? It is exactly this fiercely partisan, hopelessly false, and unutterably idiotic frame of mind which made the war possible. A permanent world-peace will never be possible until these screeching "patriots" of all nations are either eliminated or else reduced to an entirely insignificant minority. This means that a very large part of mankind has to undergo a spiritual change; and the supreme value of science lies in this, that it is a living, irrefragable testimony to the efficacy of scientific method, and the steady promulgation of scientific methods of thought among mankind is the best means of effecting this spiritual change. We are hardly at the dawn of things. Science has achieved nothing compared with what the future holds for it. We have learnt a few items of information, it is true—but that is not science. All the treatises on all the 'ologies are merely by-products. Science is a method of thought, and its importance lies in this: a method of thought means a method of life.

## Science

**Red Oxide of Mercury is now being incorporated in marine paints for coating ships' bottoms.** The poisonous nature of the mercuric oxide prevents the growth of sea plants and other organisms which foul the ship bottom and cause the vessel to lose speed.

**The Association of Official Agricultural Chemists** has decided to establish a quarterly journal, which will contain the proceedings of the association's annual conventions. From 1885 to 1912 these proceedings were published annually by the government as bulletins of the U. S. Bureau of Chemistry, but this plan has been discontinued.

**National Bird Reserves.**—According to the last annual report of the General Land Office, the national bird reserves now number 67. Three of these were created during the last fiscal year; viz., Anaho Island, in Pyramid Lake, Nevada, the home of the white pelican; Smith Island, in the Strait of Juan de Fuca, Washington, the roost of wild ducks and geese and many migratory shore birds which have been decimated by pot-hunters; and Blackbeard Island, off the coast of Georgia.

**Motion Pictures in the Department of Agriculture.**—The U. S. Department of Agriculture now maintains its own motion-picture laboratory for producing educational films on agricultural subjects. Several of these have been exhibited to farmers and other audiences by the agents of the department in connection with lectures. This laboratory has also co-operated with the Panama-Pacific Exposition Board in taking and developing subjects for other branches of the government, including the Bureau of Education, the Treasury Department, and the Smithsonian Institution.

**Revegetating Kodiak Island.**—The eruption of Mount Katmai, Alaska, in June, 1912, covered the agricultural and grazing lands in the neighboring island of Kodiak with a heavy blanket of volcanic ash. Experiments in revegetating this land, carried on by the agricultural experiment station at Kodiak, have made such progress that the government herds of Galloway cattle have been returned to the reservations in the island. It has been found that wherever nitrogen is added to the volcanic ash or where the lower rich soil is mixed with the ash excellent crops can be raised. A special plow for mixing the ash and soil has been devised at the Kodiak station.

**Wound Makes a Man See Green.**—A very interesting case is reported of a soldier, in a recent engagement, being shot in the forehead, the bullet passing out of the back of his head without killing or even stunning him. He remarked "Everything seems green all round me," and when in the hospital tent he still persisted that he saw everything green. This case appears to favor the cerebral theory of color vision of Dr. Edridge-Green, the shock to the brain having altered the discriminatory apparatus so that impulses caused by green rays had a preponderating influence.

**Research Fellowships.**—To extend and strengthen the field of its graduate work in engineering, the University of Illinois has since 1907 maintained ten Research Fellowships in the Engineering Experiment Station. These fellowships, for each of which there is an annual stipend of \$500.00, are open to graduates of approved American and foreign universities and technical schools. Appointments to these fellowships are made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the Master's degree will be granted. Not more than half of the time of the Research Fellow is required in connection with the work of the department to which they are assigned, the remainder of the time being available for graduate study. Nominations to fellowships, accompanied by assignments to special departments of the Engineering Experiment Station, are made from applications received by the Director of the Station each year not later than the first day of February. Additional information may be obtained by addressing the Director, Engineering Experiment Station, University of Illinois, Urbana, Illinois.

**A Manual of Weather Forecasting,** to which a number of officials of the U. S. Weather Bureau will contribute the results of their experience in this kind of work, is now in preparation, according to the last annual report of the Weather Bureau. This is undoubtedly a greatly needed work, since much of the technique of weather prediction, as practiced by meteorological services, has never been reduced to writing, and has perhaps not been fully formulated even in the minds of the forecasters themselves. A preliminary contribution to this subject which the Weather Bureau has just published is a voluminous series of charts with descriptive text, by Messrs. Bowie and Weightman, entitled "Types of Storms of the United States and Their Average Movements." The Bureau is also gradually putting in tangible form the knowledge gained by its officials in the forecasting of floods and river stages. Rules for the preparation of flood forecasts for the Mississippi at St. Louis and for the Susquehanna at Williamsport and Harrisburg, Pa., have recently been formulated and put into practical use.

## Automobile

**Motor Street Sweeper Saves Money.**—The city of Houston, Tex., reports that the use of motor vehicles in sweeping and flushing its streets has resulted in a saving of \$1,600 per month. The work formerly was accomplished by means of 20 mules.

**65,000 Motor Trucks in America.**—According to the latest figures obtainable there are at present 65,000 commercial motor vehicles in use in the United States, representing a cash investment of about \$16,000,000. The two largest users are the American Express Company with 750 cars, and the Adams Express Company with 650 machines.

**Spring Wheels en Masse.**—An average of 35 patents on spring wheels for motor cars and trucks have been granted per month, since early last year. Not in several years has the crop of inventions along this line been as numerous as at present. About one out of twenty gets a real test, and less than one out of a hundred survives the trial stage. There are at present ten spring wheel designs in commercial use, four of them being often seen in New York city. The rest are born, reared and die with unfailing regularity.

**A Self-adjusting Piston Ring.**—Packing the pistons in an internal combustion engine is not an easy matter, and many are the plans made to circumvent the necessity of continually adjusting and packing loose pistons. A novel type of piston ring has been invented by a Boston manufacturer, in which the use of radial holes serves to equalize the pressure between the outer and inner surfaces. The piston rings have a slightly conical shape, which causes them to be forced tightly against the cylinder walls during the compression stroke, when the tendency of "downward crowding" is at its highest.

**Muffling Exhaust by Turbine Wheel.**—A new form of muffler for the exhaust gases of automobile and airplane engines has just been brought out by a Rochester firm. It consists of a small turbine wheel which is revolved rapidly by the impinging exhaust gas, breaking its force and converting the explosive noise into a slight hissing sound. Part of the gases are caught by a baffle plate, but the back pressure caused by this is so small as to be almost negligible. There is no loss in power from the motor, and the inertia of the revolving wheel assists in drawing the exhaust gas from the pipe and manifold, even after the force of the piston movement has passed. The device takes a smaller space than the ordinary baffle plate muffler.

**12,000,000 Tires a Year.**—The average man has but a vague idea of the enormous extent of the automobile tire industry in the United States. There are at present in round numbers 1,600,000 automobiles in the country, and not one of them can possibly get along with less than 4 tires a year. As most of them use much more than that, the most conservative estimate must place the number per car at 6 tires a year. This would be 9,600,000 tires. In addition there are scheduled for manufacture during 1915 not less than 600,000 new cars, which must be fitted with at least 2,400,000 new tires, making a total of 12,000,000 tires, at the very lowest possible figuring. In reality the number is much greater, even though a million or more tires are "re-treaded," fitted with "covers," etc. Taxicabs and some of the high-powered converted racing cars could not possibly get along with less than 20 tires a year. The money spent for tires in 1914 in the United States alone probably exceeded \$200,000,000.

**"Zoline" Fails to Make Good.**—For some time past the press of this country has been deluged with sensational reports about a new and wonderful fuel for internal combustion motors that surpassed gasoline in efficiency and could be produced so cheaply that the price of motor fuels would be cut to near the vanishing point. The statement is now given out that because of its apparent lack of practical commercial possibilities Zoline, which was the subject of the Indianapolis experiments, has been dropped by the group of men who were interested in its exploitation. It is stated that among the difficulties encountered was that the naphthaline component, which gave it that moth ball smell, crystallized out in the feed pipes, thus choking the flow of fuel.

**Co-operation in Road Building Matters.**—One of the results of the Road Congress held at Atlanta was the action taken for the formation of the Association of State Highway Commissioners and Engineers. This is an association of the practical men who build the highways, and as it is recognized that the question of good roads is not in any way local, but one whose interests overlap from State to State, the conferences of such men may be expected to be productive of much mutual benefit. Preliminary steps for the formation of such an organization were taken, to be perfected at a future date. At the annual meeting of the American Highway Association, held at Atlanta, Fairfax Harrison was elected president, Logan Waller Page vice-president and Lee McClung treasurer. A number of directors were also selected.

## Astronomy

**Astronomical Telegrams.**—The European war put an end, for the time being, to the work of distributing telegraphic news of astronomical discoveries, heretofore carried on by the Zentralstelle für astronomische Telegrame at Kiel, Germany. It is now announced that this work has been assumed by the University Observatory at Copenhagen, under the direction of Prof. Elis Strömgren.

**Another Astronomical Bull.**—The last number of *L'Astronomie* furnishes a piquant addition to the long catalogue of astronomical "bulls" which that journal has recently been collecting. It appears that one of a series of paintings representing the life of Mahomet, exhibited at the last Salon, and entitled "The Tomb of the Khalifs," shows an evening sky in which the crescent moon, correctly oriented, has a brilliant star between her two horns. The idea was borrowed from the Turkish flag, which, however, does not always show the star in this impossible location.

**Proper Motion of Nebulae.**—Dr. Heber D. Curtis, of the Lick Observatory, has recently given a preliminary account of the results obtained from comparing a large series of nebular photographs made with the Crossley reflector twelve to sixteen years ago, with a similar series now being made with the same telescope. In this interval changes due to motions of translation or rotation in the nebulae are quite inappreciable, or, at most, exceedingly small. This applies to several large irregular nebulae, including the Orion nebula, and to several prominent spirals, including the great nebula in Andromeda. It is inferred from these observations that the nebulae in question are enormously remote, and therefore, of course, enormous in size.

**Variable Brightness of a Comet.**—Interesting fluctuations in the luminosity of comet Kitzinger (1914 a) were observed by M. Chofardet at the observatory of Besançon. Although after May 10th, 1914, the comet was receding from the earth, its brightness was estimated as of magnitude 10.5 on May 22nd, and of magnitude 9 on June 10th, while the head had increased in angular diameter from 30 or 40 seconds to 2 minutes. On June 20th the brightness appeared to have again diminished, but hazy weather made this observation uncertain. The above observations were confirmed by those made at Uccle by M. van Biesbroeck, who, after noting the normal diminution of the comet's brightness with increasing distance up to May 15th, was surprised to find a marked increase on June 3rd, when he estimated the magnitude as 8.5.

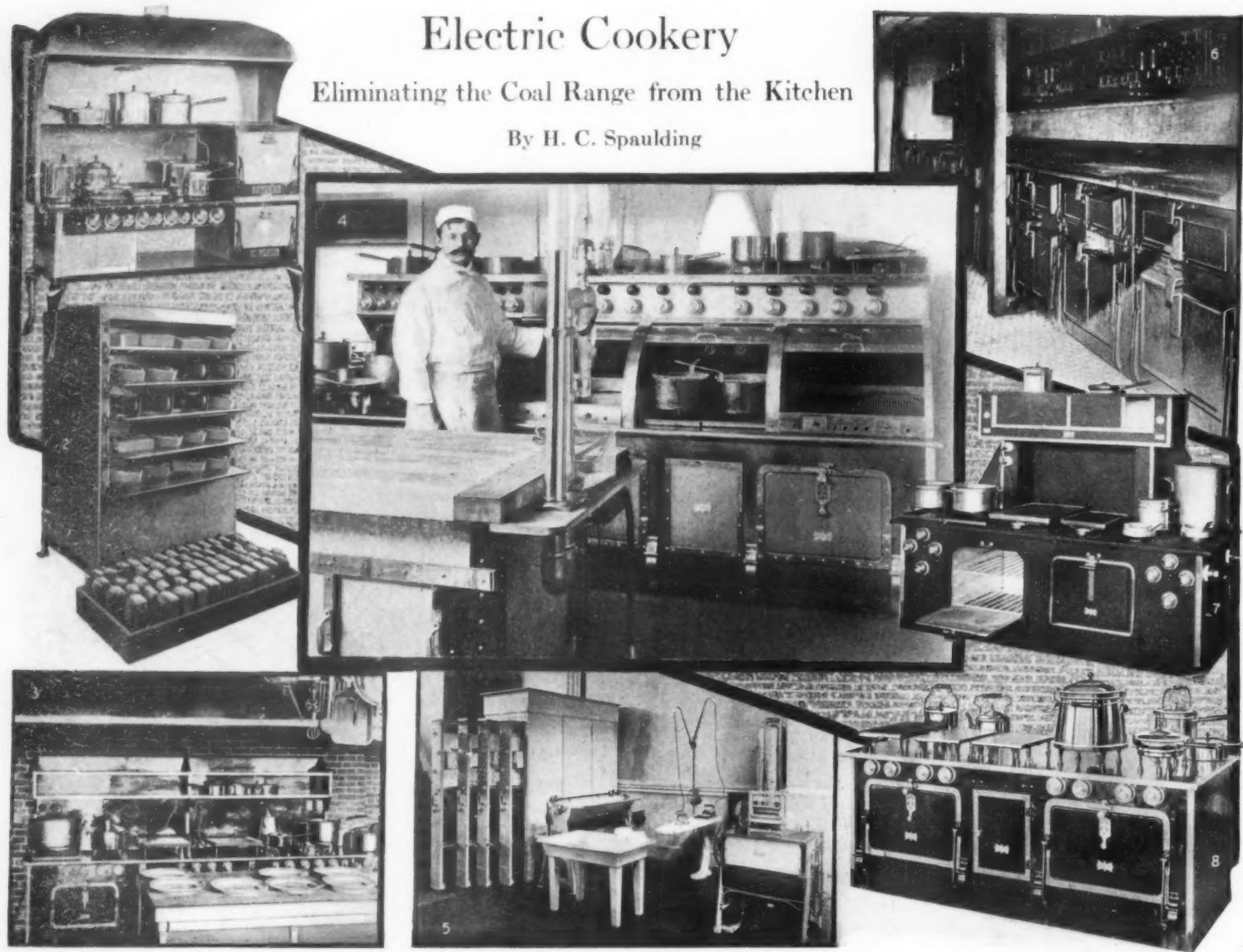
**Stereoscopic Photographs of Comets** have yielded interesting results at the hands of Prof. E. E. Barnard, who has applied this method to the study of Comet Morehouse, of 1908. Series of photographs of the comet made on the same date in various parts of Europe and at the Yerkes Observatory were available for stereoscopic combination, and from the resulting series of stereographs, extending over a period of several hours, it is possible to interpret certain curious changes in the appearance of the comet's tail. At one time the tail was abandoned and drifted away into space, where it formed an irregular ring, from which a secondary tail, in cylindrical form, was developed. Soon after, the nucleus sent out a new tail which appeared to connect with the old one, but which the stereographs show to have really passed behind the latter at a considerable angle.

**Radio Time Service.**—The last annual report of the U. S. Naval Observatory records the increasing importance of the radio time signal which the observatory sends out twice daily, at noon and 10 P. M., via the naval radio station at Arlington, and which is thus distributed broadcast over the continent east of the Rocky Mountains and over most of the North Atlantic Ocean. A case is mentioned in which a merchant vessel sailing from New York checked its chronometers daily by this signal until within 600 miles north of Rio Janeiro, or 4,250 miles from Arlington. The noon signal is also sent by radio from New Orleans and both signals from Key West, while in the case of breakdown at Arlington the stations at Newport, New York, Norfolk, and Charleston are directed to send the noon signals. In case of an appreciable error in the signal it is corrected by sending it again one hour later. The mean daily error in transmission during the last fiscal year was 0.055 second, and the maximum error 0.36 second, due to a change of rate in the standard sidereal clock resulting from recent overhauling. The number of small radio sets for receiving the time signals in use throughout the country by watchmakers, jewelers, colleges, etc., is increasing rapidly. A point requiring investigation is the lag, or difference of time, between the transmission of the signal and its arrival at a distant point. This may sometimes amount to 0.3 second. In view of the increasing use of the signals for astronomical and other purposes requiring high precision, the installation of more up-to-date sending apparatus is desirable, and a system of return signals should be arranged in order to ascertain the exact time of receipt of the signals. The observatory wants a special appropriation from Congress.

## Electric Cookery

Eliminating the Coal Range from the Kitchen

By H. C. Spaulding



Substituting electric for coal heat in private and public institutions.

1. Electric range in a private residence. 2. Baker's electric oven. 3. Range in a school at Middlebury, Conn. 4. Kitchen of the Engineers' Club, Boston. 5. An electrically equipped laundry. 6. Galley of the United States dreadnought, "Texas." 7. Range in a Colorado hotel. 8. Electric range in House of the Good Shepherd, Boston.

EVEN in these days when electric toasters, percolators, broilers, etc., for table use are an old story, comparatively few people realize to what an extent and on how large a scale electricity is being adopted for cooking purposes, not only in small or moderate-sized households, in which the safety, convenience, and uniformity of electrical methods would offset a possible increase in cost over coal or gas, but in public and private institutions where the cooking must be done in large quantities, and at first thought the use of coal or gas (with live steam when available) would seem to make for final economy.

Apparently the science of electric cookery is to-day (speaking from an economic standpoint) just about where electric street railway operation was some twenty-five or thirty years ago; a recognized possibility, of which those familiar with results already obtained were most sanguine for the future, but of which the public at large was skeptical, and inclined to consider in the light of an interesting experiment for which the manufacturer—not they—must foot the bills.

Fortunately, for the public welfare, the development of electric cookery methods has in the very nature of things been more gradual and based on more carefully and broadly obtained data than was the case in electric railroading, and at the present time its assured place in household and civic economies seems to be mainly a question of publicity and of the minor improvements inevitable in the evolution of any line of apparatus intended for general public use.

An interesting fact to be noted in this connection is that we in the United States are far behind our friends across the water in this particular line of progress and that "over here" our Western States are, as a rule, far ahead of the Eastern in their readiness to "do it electrically."

Of course the widely varying rates for current are to a great extent responsible for this, although this variance is far from being accounted for in many locations, where, as was the case in the early periods of railroad and telephone development, it seems to be the policy of certain interests to follow public demand instead of to anticipate it, or even meet it half way. When we

realize that the cost of electric current in some parts of this country is about four times what it is in others for electric lighting and approximately eight times for cooking, it is not to be wondered why this difference exists and whether it is due to geographical or (local) financial conditions, especially as in some parts of England the rate for current used for cooking purposes is only about one-fifth of the minimum rate here in America.

The explanation obviously involves so many considerations that it is beyond the scope of this article, but briefly, the difference in cost to the consumer is mainly due to (a) geographical and (b) governmental causes.

In certain localities the development of large water powers has made possible hydroelectric installations which are furnishing electric current at rates which would be impossible where fuel must be freighted, stored and used under ever-varying conditions.

By "governmental" causes we mean primarily taxation methods, which vary in a degree almost unbelievable by those who have not made a special study of the subject. In one instance, that of a central station in one of our largest cities, the total amount of taxes paid is almost exactly equivalent to the net cost of current generated and delivered at the station bus bars!—and this is under a "normal" (?) administration.

The average consumer does not stop to consider that the price charged him for current represents (a) actual cost of generation, interest on plant investment, taxes and insurance, (b) distribution, including leakage (engineering and financial), superintendence, etc., and (c) administration cost, including executive, engineering, legal expense, etc. However, it would seem, in spite of the possibilities for future development, that electrical cooking methods have become an accomplished fact so far as the average household is concerned, since recent investigations on the part of a non-prejudiced authority showed that *more homes in the United States use electric current than are provided with running water*, and wherever electric current is installed electric cooking is a logical and inevitable result.

In public institutions, most of which have their own "isolated" plants, economic considerations are of still

greater importance. The current required for cooking purposes is almost entirely an "off-peak" load, and when properly combined with lighting, refrigeration and general power service shows an evident economy over distinct functional operation.

One peculiar feature of electric cooking, aside from safety (no matches, no leaky pipes, no open but unit valve cocks) is that in cooking meats, fish, fowl, etc., whether baked or broiled, the actual loss in weight or "shrinkage" is much less than when the cooking is done by coal, charcoal, or gas.

As a result not only is there a saving in "bulk," but the food is much more palatable, since the natural juices and flavors of the meat are retained instead of going up the chimney or ventilating flue in the form of vapor, representing a definite economic loss.

That electric cooking on a large scale is no longer an experiment but on an economical as well as practical basis is evidenced by the decision on the part of the engineers of one of the big western trunk lines to use electrical equipment throughout in the kitchens of a new \$350,000 station, no coal whatever being used in the building except for general heating purposes.

Now as to cost: A favorite unit basis with writers on this subject (and their name is legion) for computing cooking expense is the "kilowatt-hour at ten cents per." Without attempting to explain what a "kilowatt-hour" is, suffice it to say that your bill for current is based on the number of them used, just as the gas company charges so many "cubic feet" of gas, as shown by the gas meter, at a certain rate.

No one ever saw a cubic foot of gas and no one ever saw a kilowatt-hour of electric current, but the bills and checks representing them are an every-day story.

Very good. The price of these commodities varies all over this big country of ours, for reasons outside the scope of this article, but any reader can find out for himself or herself just what the charge would be per kw-hour (note the simple abbreviation) and figure out the cost to himself or herself of various operations, from the following data based on a *ten-cent rate*, which is actually in force in many of our large cities and

(Concluded on page 74.)

# Where the Smoke Helmet Would be Invaluable

## A Lesson from the New York Subway Fire

**T**HIE disaster in the New York subway tunnel, where many hundreds of helpless people escaped death by suffocation from smoke and noxious fumes entirely by good luck, conveys a warning to the whole country in regard to one feature of public safety for which but little provision has been made. Of course subways are not numerous, but what occurred in New York is but an exaggeration of what might happen in many other localities on a smaller scale, and wherever human life is concerned it is well to take thought for its preservation in advance.

In the New York disaster hundreds of passengers in the trains that were caught in the tunnel were rendered unconscious by the smoke and fumes of the burning insulation of the feed cables that carried electricity for supplying power and light to the trains and stations, and their rescue from their dangerous position was slow and rendered difficult because the atmospheric conditions in the tunnel prevented the firemen from reaching these helpless people promptly, and many of the firemen themselves were overcome and required the aid of the pulmotor, which undoubtedly saved many lives. That the casualties were so small was entirely due to the fact that the accident occurred at a point where the subway tunnel was very close to the surface, where a number of openings to the upper air were available; but had it happened at some of the deeper points, probably not one of the fifteen hundred or more passengers in the trains stalled near the point of the accident would have survived.

The lesson of the disaster points most forcibly to the necessity for some device that would enable rescuers, whether firemen or others, safely to penetrate dense smoke and efficiently to carry on the work of rescue. Such devices, generally known as smoke helmets, are by no means unknown, and are in common use by the fire departments of many foreign cities, as well as by a few cities in this country; but in the present case it is the astonishing fact that not a single smoke helmet was available, although the New York fire department is supposed to be one of the best equipped in the world. Why such a condition should be permitted to exist is impossible to ascertain, but it is known that this department has in a casual way considered the subject of some device that will permit its men safely to penetrate thick smoke in confined situations, but nothing definite has developed.

That the New York fire department should take such an apathetic attitude in this matter is the more surprising, as the reports of almost every big fire in the city contain mention of firemen being overcome by smoke while engaged in the performance of their duties, and in some cases we read of firemen being laid out in rows on the sidewalk, where remedial treatment was applied. As long as this indifference to human safety was confined to members of the paid department the public has assumed that such things were unavoidable, or at any

rate all a part of the day's work of a fireman; but since the dramatic incident in the subway people are realizing that it is a subject that is of vital interest to them, and undoubtedly movements will result that will compel the New York fire department to properly equip itself for the saving of life as well as saving property.

As originally organized, all fire departments were in-

regular use of this means of enabling their workmen to safely conduct operations where dangerous acid fumes exist. In refrigerating plants pipes containing liquid ammonia under great pressure sometimes give way, and except for the use of a protective helmet which enables a workman to enter the unbreathable atmosphere and either repair the damage or close the necessary valves, the establishment might be shut down for an indefinite period and the entire neighborhood endangered.

Passing over the very numerous instances abroad where these life-sustaining devices have been in successful practical use for years, we have a splendid example of what can be done in this direction in this country in the mine rescue work organized by the U. S. Bureau of Mines. When an explosion occurs in a coal mine there is always dense smoke, great quantities of noxious gases, with heavy clouds of stifling dust, conditions practically as bad as existed in the subway fire; but by the use of protecting helmets and apparatus carried on the shoulders of the rescuer, which supplies fresh air, it is possible for a man to enter the most unwholesome passages and save lives that only a short time ago would have been surely lost long before the shafts and tunnels could be cleared of the foul gases and fresh air substituted by the ordinary means. This is not a theory, nor an experiment, for the Bureau of Mines has established a large number of rescue stations at which these helmets are the principal piece of apparatus, and some thousands of miners have been taught to use them; and this organization is constantly saving lives, and has a long record of rescues that meets any argument against the value or the practicability of the device. This record also plainly demonstrates that apparatus of this kind can be successfully used by men of ordinary intelligence and under unusual and trying conditions. These smoke helmets, of which

there are quite a variety, usually take somewhat the form of a diver's helmet, although they are of very light construction, as it is only necessary that they keep out smoke and gases. In some cases, where the atmosphere to be encountered is not injurious to the eyes, only a small cone covering the mouth and nose is used, but for general use some sort of a hood that fits closely around the shoulders and is provided with a window and connections for receiving and discharging air is the favored form.

For providing the wearer with air there are several systems employed. The simplest, which is quite extensively employed by fire departments, and which serves its purpose quite well under simple conditions, consists of a light close fitting hood, with a sight window, and having a large tube of airproof cloth that extends down close to the floor, where it gets a supply of moderately fresh air, for in a fire it is well known that the heated

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Breathing device for use  
in coal mines.



Type of helmets used in German  
fire departments.

tended to be protectors of property only, but the frequent presence of human beings in burning buildings compelled the firemen to extend the scope of their duties and activities; and although the title of such a city department has never been changed, the saving of life has come to be such a recognized function that the firemen are now always called upon as a rescue corps in every case of disaster. Under the circumstances it would be logical to plainly recognize the modern position of the organization and call it the Department of Public Safety, equipping it accordingly.

Devices that enable men to enter places filled with dense smoke and noxious gases and remain for considerable periods of time have been known for many years, and although they undoubtedly have not reached their ultimate development, there is no question but that there are several on the market that are entirely practical. Indeed, many private commercial establishments, such as chemical works and refrigerating plants, make



Fireman's smoke helmet, front view.



Helmet men belonging to one of the Rescue Stations established by the U. S. Bureau of Mines entering a gallery after an explosion.



Smoke helmet, showing intake near floor.

# Disastrous Burnout in a Subway Manhole

## Lessons that Are Taught by the Accident

A SERIOUS short circuit occurred in the power cables of the New York subway during the morning rush hour on January 6th, which set fire to the insulating materials surrounding the cables, liberating large volumes of smoke and gases that asphyxiated hundreds of passengers in trains stalled in the immediate vicinity. That only one death resulted was due to good fortune rather than any special provision for such an occurrence. It was the most serious accident that has ever occurred in the subway system of New York and it has focused public attention upon a defect that has existed ever since the line was built.

### Power System of the Subway.

The power for the subway system is generated in a large plant at Fifty-ninth Street and Eleventh Avenue. From here alternating current is transmitted to substations, at a tension of 11,000 volts, through cables carrying from 3,000 to 5,000 kilowatts (4,000 to 6,700 horse-power) each; at the substations the power is converted into direct current and transformed to a tension of 630 volts. From each substation low-tension cables carry the current to the subway, where it is delivered to the third rail at stated intervals. Unfortunately, the subway system has no independent right of way for its transmission lines, except for the short cross-town lines running from its various substations and from the main power station. Hence, the subway itself is used to carry the power lines. They are placed in conduits behind the subway walls.

The main high-tension cables come to the subway at Fifty-eighth Street and Broadway and thence run north and south. At various points, where they run out of the subway line to the respective substations, manholes or "splice chambers" are provided, and here low-tension cables enter and turn north and south to feed the power rails. Cables are also carried across the subway to splicing chambers on the opposite side. Not only are splicing chambers provided at the junction with conduits leading to the substations, but also at intermediate points, because it is impracticable to make and handle the heavy cables in lengths of more than 500 feet. The splicing chambers may be entered from the subway through a doorway normally closed by a steel door lined with asbestos, and in most cases they can be entered through a manhole from the street as well.

### Cable Insulation.

In electric power transmission we have the curious anomaly that we must depend upon highly inflammable material to prevent fire. The matter has been studied for years, but so far no insulation has been developed that is fireproof and yet waterproof and flexible. Feed cables cannot be introduced into conduits unless they are flexible. The usual high-tension cable construction consists of a multiplicity of copper wires imbedded in a mass of paper or rubber insulation, the paper being treated with some compound to exclude air and moisture. Over all is a lead sheathing to protect the insulation from injury and from climatic conditions.

No matter how carefully the cables have been constructed this insulation is liable to give out at some time. There may be a slight injury to the lead sheathing which would admit moisture. There might be a slight imperfection in the insulating body during the process of manufacture. Deterioration is very apt to set in, and some day when the insulating qualities are sufficiently weakened or an excessive current passes through the cable there will be a complete breakdown—the current will jump from the core of wires inside to the sheathing outside.

Every month the cables of the New York subway are tested by subjecting them to a current three times as great as they are normally adapted to carry, so that if there be a weak spot anywhere it will be discovered. Every effort is exerted to make the splices, electrically, much stronger than any of the rest of the line, but it is at such points that breakdowns are most apt to occur. The main enemy of insulation is moisture, and for this reason there are ventilating gratings in the doors opening from the subway into the splicing chambers.

### Nature of the Short Circuit.

It was in the splicing chamber on the west side of Broadway at Fifty-third Street, where the cable lines connect with the Fifty-third Street substation, that the accident occurred. Just what was the cause of the short circuit no one knows and no one ever will know. Short circuits may occur several times in a month and again not once in a year, but in each case the evidence is entirely consumed and one is left to guess at the probable cause for the breakdown.

In the opinion of the subway engineers, it was probably one of the low tension cables that first gave way, because the arc produced by direct current is apt to be

more sustained. When this cable gave way, whichever one it was, it melted out adjacent cables. These in turn were short-circuited and set fire to the rest of the cables successively. The system being thus electrically unbalanced apparently threw an excessive load into the cables on the opposite side of the subway and they also were short-circuited. It was all a matter of a few minutes, but the insulation continued to burn and send off large volumes of smoke and gas which passed into the subway proper.

### Automatic Circuit Breakers.

There is an automatic provision for cutting off the power in a cable system whenever there is an excessive flow of current. A relay circuit is acted upon inductively to energize an electromagnet. The armature of this magnet closes another circuit which operates a circuit breaker in the substation or power plant, thus automatically throwing off the power.

The object of these automatic circuit breakers is not so much to prevent a short circuit, for this they could not do in the majority of cases, but to protect the apparatus at the substations. An enormous amount of current passes through the cables and in case of short circuit an arc could be maintained, which would do a great deal of damage without drawing enough current through the cables to operate the circuit breaker.

In each splicing chamber there is also an apparatus which may be operated by hand to throw off the power. Whether the power was cut off automatically or by hand is not clear at the present writing, but after a number of the cables had been short-circuited all the power of the entire subway system was cut off and the subway was plunged in darkness.

### Subway Lighting System.

Although the subway is lighted by a separate transmission system from that of the third rail, the cables coming directly from the power plant and not from the substations, yet in this emergency, the lighting cables, being adjacent to the power cables, also gave way.

The cars themselves are provided with emergency lamps supplied from batteries, floating on the line, so that they are normally kept charged with sufficient current to keep the lights burning for three hours. They are arranged to light the lamps automatically when the other lamps are extinguished, but for some reason, as yet not clearly determined, some of these lighting systems failed.

### Fire Escapes and Emergency Exits.

To provide ventilation for the subway there are blower fans at intervals situated in ventilating chambers. These also ceased operation as soon as the power was cut down. That there was not an appalling death list is attributable to the ventilation chamber at Fifty-fifth Street, whence there was an exit to the street by way of a ladder. Fire escapes of this sort are provided between all stations from City Hall to Columbus Circle except between the Grand Central and Thirty-third Street stations.

### Conclusions.

As a result of all these conditions the following conclusions may be reached, although they are subject to modification when the investigations which are now being conducted have been pursued to their end:

First: There must be no communication between the splicing chambers and the subway proper. Of course the question of properly ventilating the chambers is involved. Many of them are not wide enough to be simply walled off from the subway, but would have to be enlarged or entirely reconstructed. In some places, for instance, the subway is far underground and a shaft 60 feet deep would be required to provide access to the splicing chambers. The mere provision of a door between the splicing chamber and the subway, even though there were no ventilation opening in it, would be inadequate, because the explosive effect of a burnout would burst them open.

Second: The subject of lighting. Panics cannot be averted without ample lighting. It has been hinted by the Public Service Commission that it might be advisable to light the subway from an entirely separate transmission line, possibly from the street lighting circuits, thus keeping the lighting cables far removed from the power cables and running them into the subway at frequent intervals, so that, in case of a failure at one point, at most only a small section of the subway would be darkened.

Third: The provision of fire escapes. In no public buildings, where such large numbers of people assemble as are to be found in a single subway train, are there such inadequate emergency exits. There should be fire escapes at more frequent intervals and these should consist of broad stairways rather than mere iron ladders wide enough for one person to ascend at a time. In the

new subways that are being planned the ventilating chambers situated between stations will be provided with stairways four feet wide to serve as emergency exits. In the case of the East River tubes there should at least be cross passages from one tube to the other.

Fourth: Ventilation. If it is necessary to provide a separate lighting system, it is equally necessary to provide separate circuits for the ventilating fans, for with the ventilation (which is not of the best at any time) cut off, the danger of asphyxiation is very great in a system where practically all the inflammable material is of a type to give off dense, choking fumes.

Fifth: Fireproof cars. We hesitate to think what horrible results might have attended the stalling of a wooden car within the reach of the blowout. We understand that the promise to eliminate all wooden subway cars very soon has already been given.

Sixth: Communication with stalled trains: It would not be a difficult matter to install a telephone system which could be tapped at any point by the conductor of a train, enabling him to get into touch with a dispatcher and obtain immediate and direct instructions in an emergency. Too much reliance is now placed in the individual judgment of the conductors and guards.

### The Sun "Drawing Water"

WHEN beams are seen radiating from the sun, especially when they are directed toward the horizon, the sun is said to be "drawing water," and this phenomenon is popularly regarded as a sign of rain. Probably most children, and perhaps a few grown-ups, have fancied when looking at this pretty spectacle that the lines of light and shadow converging toward the sun were actually streams of vapor which the luminary was sucking up from the earth and which would presently condense into clouds and showers. These lines are, however, the result of the passage of sunlight between clouds already formed. The dark lines are cloud-shadows; the bright lines, sunbeams made visible by the presence of dust or drops of water in the air—like the sunbeams seen in a dusty room. The beams and shadows are really parallel, their apparent convergence or divergence being the effect of perspective. As a rule, the hazy condition of the air that renders the beams visible indicates an active condensation of moisture, and therefore has some value as a prognostic of rain, though like other local signs, it often fails.

A phenomenon of similar origin is often seen when the sun is below the horizon. In this case a fan-like sheaf of beams is seen spreading upward; lines of blue alternating with the pink of the western sky at sunset, or the eastern sky at sunrise. The morning phenomenon gave rise to the classical description of the "rosy-fingered dawn." The technical name of these fan-like beams is "crepuscular rays." A rarer phenomenon is that of "anticrepuscular rays," which appear to converge toward a point on the horizon opposite the sun. Crepuscular rays are sometimes called "diverging beams," and anticrepuscular rays "converging beams," though the expressions "diverging" and "converging" are necessarily relative terms.

One of the most picturesque legends connected with the solar beams is that told in the islands of the South Pacific, where the beams are known as "the ropes of Maui." It is related that in former times the sun-god, Ra, was not so regular in his habits as he is to-day. In fact, he caused the South Sea islanders much annoyance by setting in the morning, or at noon, or at other inopportune times, just when his light was needed for the daily tasks of mankind. The great hero Maui undertook to cure him of these erratic habits, and the first step was to make the sun-god prisoner. This was accomplished by laying a series of six snares, made of strong cocoanut fiber, along the sun's path in the sky. When the deity next rose from Avaiki, or the land of ghosts, the first noose encircled him, but slipped down and only caught his feet; the second slipped too, but caught the sun-god's knees; the third caught around his hips. Still Ra pressed on, scarcely hampered by these contrivances. The fourth noose tightened around his waist, the fifth under his arms, and finally the sixth and last caught him around the neck and almost strangled him. Then the sun-god confessed himself vanquished, and, in fear of his life, promised Maui that he would in future adjust his daily journeys more in accordance with the comfort and convenience of mortal men. Ra was then allowed to proceed on his way, but Maui prudently declined to take off the ropes, which may still be seen hanging from the sun at dawn, and when he descends into the ocean at night. Hence the islanders say, when they behold the beams radiating from the sun, "Tena te Taura a Maui"—"See the ropes of Maui."

### A New Whole Wheat Flour

By Charles Maxner

**T**HIE theory of modern flour-milling has been from the beginning to separate the flour substances contained in the wheat kernel from the less easily digestible shell particles. It is interesting to ascertain the reason for this practice and why it is that the contents of the entire grain, as provided by nature, are not used for making flour and bread.

In this connection we have to consider first the prevailing idea that bran is unsuitable as food for human beings, and particularly for bread-making, because of the indigestible qualities of the bran. Moreover, there is the indubitable drawback that the public demands white bread. To meet the tendency in this respect, it has been necessary to "improve" the natural color of flour by artificial means, and, as a result, flour is often treated by chemical processes, such as bleaching. The facts referred to above are the principal reasons why bread made of white flour only is still on the market. But as soon as the bran is rendered as digestible as ordinary good flour I feel confident that the preposterous demand of the public for white flour will come to an end.

Hygienists and millers well know that the most nutritious substances of the wheat kernel are contained in the hulls and not in the flour body. Therefore our main task is to render the nutrients of the bran digestible. Attempts have been repeatedly made in this direction and have resulted in the production of various kinds of bread which, however, are far from being wholly digestible. Consequently, the assertion of hygienists that bran is only a burden to the stomach still prevails. In consequence of this theory, the whole amount of bran has been put aside as unserviceable as food for human beings. This is all the more regrettable when we realize that this abandoned fourth contains more nutritive substances than all other portions of the grain. Bran is now used mainly as food for animals, but since there are many waste products from other sources which could be used for this purpose in place of bran, it would be much more important to make it thoroughly available for men.

This important subject, dealing with the chief food for human nourishment, has been under investigation and discussion for a long time in Europe by hygienists and chemists. Some time ago, Prof. Dr. Finkler of the University of Bonn, Germany, placed on the market his newly invented process which solved this problem in a most remarkable manner. Prof. Dr. Finkler ascertained that a perfect digestibility of the nitrogen in the bran could be attained if all the gluten cells of the bran were broken open and the albumen thus exposed. This effect could not be brought about by the ordinary comminuting processes, for, as mentioned above, even the most thorough grinding and pulverizing could not produce a complete breaking up of the gluten cells. Prof. Dr. Finkler's process for rendering the bran-flour as fully digestible as white flour is carried out by the application of special machines. However, as this bran-flour does not possess enough starch, it has to be mixed with white flour, usually in the proportion of 25 per cent bran-flour and 75 per cent white flour, for making bread. It will be seen that in this bread all the substances of the grain are utilized and in their exact ratio.

An analysis of this bran-flour shows that it contains approximately:

	Per Cent.
Albumen	18
Starch	45-55
Crude fiber	7-12
Fat	3
Ash	7

It will be seen from the above statement that this bran-flour is a very nutritive product because of its contents of albumen, fat, and salts (ashes). This flour is, of course, almost identical to raw bran as regards the chemical characteristics, but there is, however, a great difference between albumen enveloped by the cell walls and liberated albumen, as to the digestibility and solubility. The true importance of Prof. Dr. Finkler's process lies in the fact that the albumen contained in this flour is rendered as easily digestible as the ordinary white flour.

The reader will be interested in knowing something about the bread made with this flour. The bread is loose and contains no trace of particles that feel gritty between the teeth; it is therefore entirely dissimilar to the old-fashioned whole wheat breads. Since the bread itself no longer contains any coarse bran-particles or unopened gluten cells, only a very small percentage of the particles of the outermost shell can be detected by means of a microscope after the consumption of the bread. Owing to its pleasant taste, I am sure that the bread will be eaten willingly.

The technical side of this invention has been so well taken care of that it will in no way interfere with the existing flour-milling systems. It will only be necessary to subject the bran, as it comes from the mills, to the special machines used for carrying out this process in

order to realize a product as finely ground as the ordinary white flour. After mixing about 25 per cent of this bran-flour with 75 per cent white flour, and following the usual baking procedures, a bread furnishing more nutrients to the body and easier digestible than the bread made of ordinary white flour will be attained.

I earnestly hope that the people will realize why they should extend a hearty welcome to this new whole wheat bread which is particularly good and contains an especial nutritive value, because it is prepared from the entire grain, as God made it.

### Hunger Strikes an Aid to Good Health

By Maud DeWitt Pearl

**R**ECENT scientific experiments will come as a surprise to the skeptical individual who scoffs at the numerous dietetic fads which, within late years, have been exploited in various magazines and which demand, as a preliminary stage in the treatment, a period when no food is to be eaten.

Prof. Carlson of Chicago University, whose work upon the digestive system is so well known, may be regarded as having settled definitely any doubt as to the beneficial effects of abstaining from eating for a period of time and to have proved that this feeling is not due solely to enthusiasm for a cause, as many maintain. It must be said, however, that he and his co-worker did not go to the extreme, as is so often the case with the faddist, but endured starvation for only five consecutive days. Furthermore, they were both in good health when they began the experiment. Aside from the fact that they slept in the laboratory at night, in order to facilitate making the records, they lived their regular lives, teaching and lecturing throughout the five days.

The original experiment was to investigate the hunger contractions of the empty stomach. For the purpose

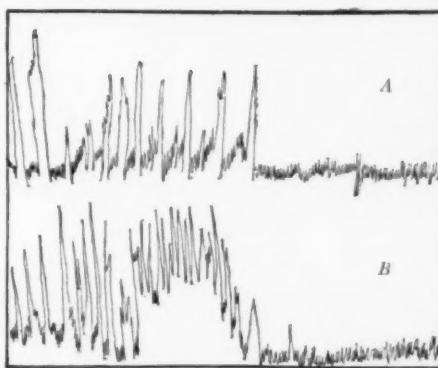


Diagram indicating the contractions of the empty stomach during the last ten minutes of a typical hunger period.

*A*, tracings made ten hours after a meal; *B*, tracings made after five days' starvation. Note the increase in the frequency and strength of the contractions in *B*.

of recording such contractions, Prof. Carlson used a rubber tube to which a rubber balloon was attached. The person upon whom the records were to be taken swallowed the balloon. A chloroform manometer, which was attached to the tubing at the other end, recorded the frequency and strength of the contractions. Previous experiments have shown that the normal stomach is never in a state of complete rest, but that the muscles are continually contracting and relaxing. There will be a period of strong contractions, the hunger contractions, followed by a period when the contractions are very feeble. The starvation records showed that there was an increase in the strength of the stomach contractions as well as in the frequency of the hunger periods, as the fasting was prolonged. During the night both the strength and frequency of the contractions were more pronounced than during the daytime, the records showing that during practically half the time the stomach was begging for food.

The sensations of hunger which were experienced and the hunger contractions of the stomach did not accompany each other, for after the first day and up to the end of the third hunger was continuous and severe; but on the fourth and fifth days the desire for food became greatly diminished. In the case of Prof. Carlson, his appetite remained good, but he found it fairly easy to dismiss from his mind the thought of eating. His assistant, on the other hand, did not find the sight of food at all pleasurable, but experienced a feeling of nausea. As would be expected, both of the men felt somewhat weak and depressed mentally toward the end of the experiment, but much of this disappeared after the first meal and was entirely gone by the second or third day after normal eating was resumed.

While these results are of interest to all, yet of far greater general interest are the after effects of the starvation experiments. To quote Prof. Carlson: "The

writer felt as if he had had a month's vacation in the mountains. The mind was unusually clear and a greater amount of mental and physical work was accomplished without fatigue. In the writer's own case the five days' starvation period increased the vigor of the gastric hunger contractions to that of a young man of 20 to 25 (the age of the professor is about 38), and the empty stomach retained this increased vigor for at least three weeks after the hunger period, when observations were discontinued, owing to absence from the university. This improvement, or rejuvenation of the stomach, is not a matter of subjective opinion, but a matter of objective record on the tracings." While many centuries have passed since man has become a civilized being his physiological constitution is undoubtedly little altered from what it was in distant ages when, because of his primitive methods of living and his inability to cope with climatic conditions, he was forced to endure periods of hunger. Because of this he was undoubtedly in better health than his descendants.

Prof. Carlson does not maintain that starvation is a cure for ill health, although he believes that "there is more value in some of these measures than is ordinarily considered," but he does think that very possibly, in the case of adult healthy persons, not only would they experience a general feeling of rejuvenescence if they underwent hunger strikes with their digestive systems, but that possibly their length of life might be also increased.

### Drop Head, a New Ailment

By Dr. Leonard Keene Hirshberg

**H**AVE you ever heard of *Kubisagari*? Ask the next hundred or two doctors whom you meet, especially medical society physicians, what this word signifies, and you will be amazed to find how few know about it.

*Kubisagari* is an old disease discovered by new doctors. It is a malady which occurs in two small districts of North Japan and on the Franco-Swiss frontier.

A few instances of the disorder have been reported in England and Canada, but no physician has yet in this country has found one example, although there are possibly hundreds of them at large in America.

*Kubisagari* means *drop-head*. The dropping of the head forward, to the side and backward is one of the noteworthy symptoms.

A young Japanese doctor who had just settled in a country district in the north of Japan found one day at his door a peasant with his head bent forward on his breast.

"What do you desire?" asked the young doctor.

"I have drop-head," he replied.

"What is drop-head?" asked the doctor.

"Why, our whole village is filled with this trouble," he replied.

The doctor at once became interested and reported his studies to Dr. P. L. Couchoud, who gives them to the world, so that other physicians may unearth similar instances of the trouble in their country.

The important and striking symptoms of *Kubisagari* or drop-head are exhaustion and flaccidity of various muscles.

Muscles of different parts of the body lose their tone very suddenly. This takes place particularly when the body is brought into action, when the muscles come into play. The eyesight also becomes affected and dizziness with vertigo occurs.

Milkmen and milkmaids, while milking the cattle, abruptly find their hands become numb and useless. The head falls forward against the cow, and the victim falls over against the cow or he rolls over on the ground. Dr. Gerlier is the one to whom has fallen the honor of finding the first sufferers in France. He noted first that the muscles of the fingers relaxed rapidly. Each spell, he says, lasts ten minutes. Sometimes they last longer, and run into each other and fuse.

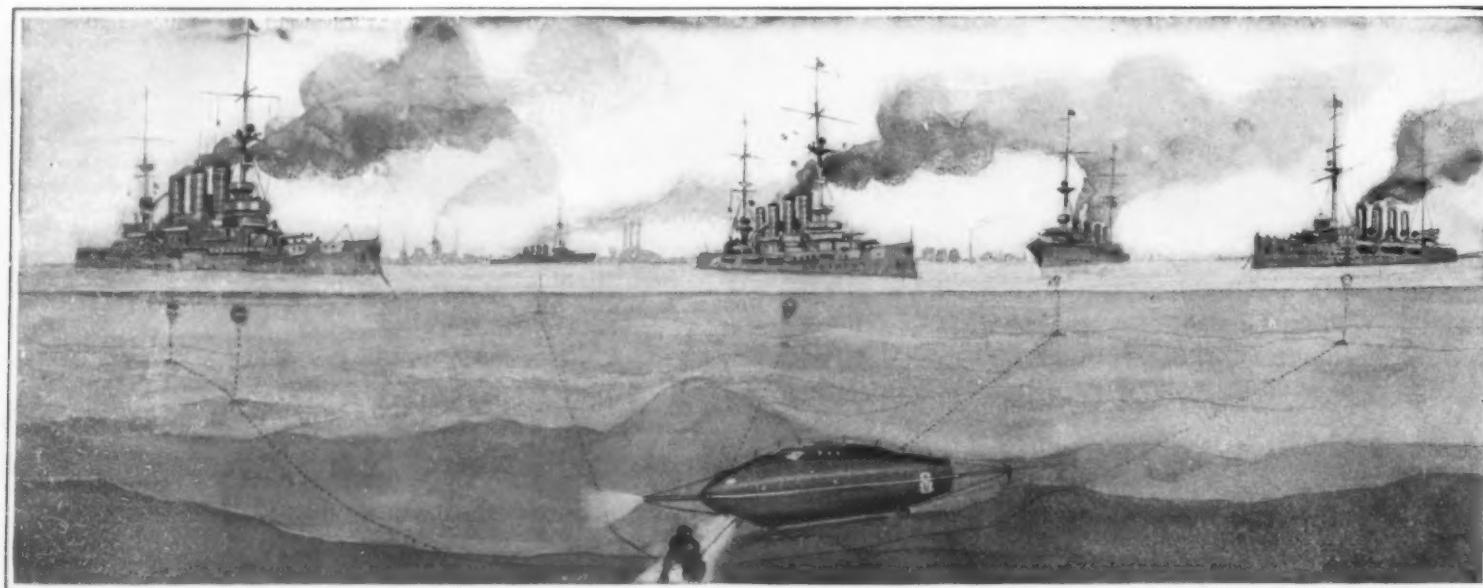
Fatigue and excessive muscular exertion seem to be responsible for the origin of the attacks. The afternoon and night seem to be the most susceptible periods.

The whole illness lasts about five months. Those who work around cattle, poultry, cats, horses, and especially milk and stables, seem to be particularly associated with the affection.

Dr. Couchoud has gone even further than any of the other investigators. He has found the cause of drop-head or *Kubisagari* to be a little dot-shaped coccus or bacteria. It is found in the spinal fluid. If this fluid is inoculated into cats, the same disease comes into being. In brief, the cat eventually falls ill with his affliction.

They are now at work in an effort to find an antitoxin or vaccine to cure and prevent the little known trouble.

**C**ommander E. R. G. R. Evans, R. N., who was second in command of Scott's Antarctic expedition, and who recently lectured on the expedition in the United States, has just been appointed to command the torpedo-boat destroyer "Viking."



The mines are planted below the warships by a diver, who makes his exit through the trap-door of the front compartment. They are so planted that at a given hour, in a certain state of the tide and current every ship will be above a mine-field. The firing cables are led to the submarine, which detonates the mines simultaneously.

Mine-planting by submarine.

## Submarines That Are Strictly Invisible

### A Type That Can Pass Through a Mine Field and Attack a Blockaded Fleet

By Simon Lake

**I**T has been well established that submarine boats should be divided into two classes; one, a torpedo boat with as high surface and submerged speed as it is possible to attain, with a large radius of action, capable, if possible, of exceeding battleship speed when on the surface so that it may intercept a battle-fleet on the high seas and submerge in its path of approach before being discovered; the second class should consist of smaller, slower speed, mine-avoiding submarines, with torpedo and mining and counter-mining features. Such submarines are essentially defensive; but if they have sufficient radius of action to reach the enemy's harbors and to lie in wait off the entrance to such harbors, or to enter submerged the harbors themselves and there destroy the enemy's craft, they have become potent offensive weapons of the raiding fleet. For a European power it is relatively easy to give such boats the radius necessary for them to invade an enemy's ports.

I have not pushed the consideration of the submarine of the second class, with its anti-mine features, because I have been kept busy trying to profitably meet the wishes of the various governments which demand constantly increasing speeds at a sacrifice of some characteristics which I personally regard very highly. Most governments have been more attracted to vessels of the first class, as speed in all classes of vessels more than anything else seems to appeal to the imagination; but I think it may be the old story of the "Tortoise and the Hare" over again; and I refer to the recommendation of a special board, appointed in 1903, recommending the purchase of a number of Lake type boats for the defense of our own coasts as a proof of this contention.

As regards the first class of submarines, the present submarine boats engaged in the Continental war consist of vessels only a few of which have a surface speed exceeding 12 knots or a submerged speed exceeding 10 knots for one hour or 8 knots for three hours. There may be a few in commission that exceed these speeds, but very few. Some are in course of construction that are expected to give a surface speed of 17 and 18 knots for forty hours and about 11 knots submerged for one hour, or a slower speed for a greater number of hours.

Governments are asking for bids for submarines of greater speed, and some have been designed which are expected to make 20 knots on the surface. How-

*Simon Lake, the inventor of the even-keel submergence submarine torpedo boat, which in its ship-shaped form with double hull and buoyant superstructure, a form covered by Mr. Lake's patents in the United States, Russia, Austria, Germany, and Italy, is of the opinion that the full capabilities of the submarine boat have not even yet been fully realized. Mr. Lake has developed a great variety of submarine vessels for various commercial purposes, as well as for war, and he is well qualified, because of his great variety of submarine experiences, to discuss the possibilities of the submarine in warfare.—EDITOR.*

ever, none of them are in service as yet. One reason that higher surface speeds have not been reached is the difficulty of securing a perfectly satisfactory high-power, heavy-oil, internal-combustion engine, suitable for submarine boat work. As soon as a proven satisfactory heavy-oil engine is turned out by the engine builders, capable of delivering 5,000 horse-power per shaft, submarine boats may be built capable of making up to 25 knots on the surface.

The largest heavy-oil engines so far built for submarine boat work develop about 1,300 horse-power per shaft; but rapid progress is being made, and I believe that 25-knot submarine boats will be laid down within the next two years. Even this high speed, however, will not fulfill the destiny of the submarine, which, in my opinion, is a weapon destined to promote peace

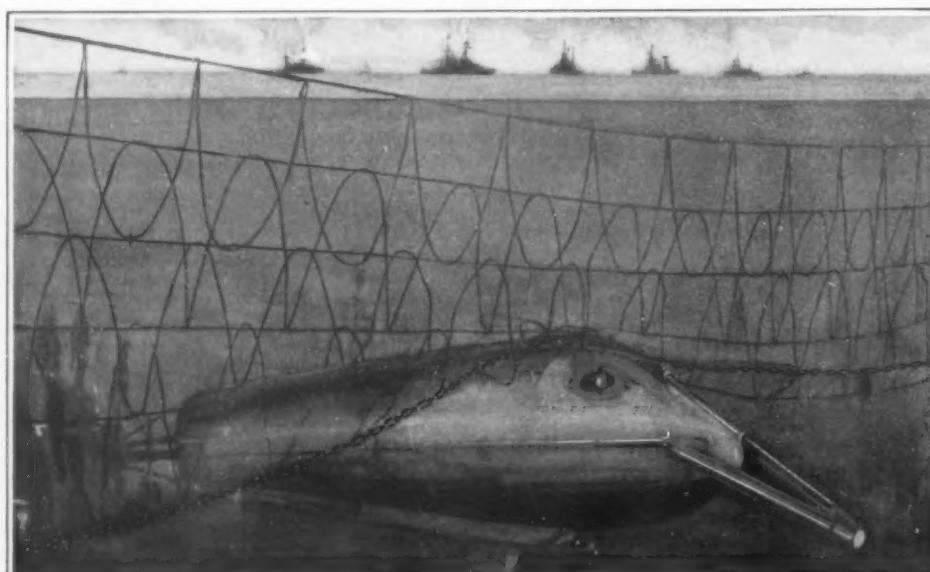
between maritime nations by making it impossible for one nation to invade or harass the coast line of another nation where submarines exist, and by making it impossible for the enemy to leave their own ports or harbors with an invading army or armed vessels.

The submarine, even at its present development, has shown its superiority over the battleship in coast operations; however, to intercept a battleship at sea, even a high speed submarine must lie in wait, perhaps for days or even weeks at a time, much like a gunner in a "blind" waiting for a flock of ducks to pass within gun shot. Because of its relatively slow speed, it would have to wait a long time, also, for a battleship or fleet to pass sufficiently near to be headed off, especially if the submarine were entirely submerged, because the moment the periscope appears above water the quarry will take to its heels, if it follows the latest ruling of the British Admiralty, "to steam away from the vicinity of submarines at full speed, even if it is necessary to abandon a torpedoed sister ship and its drowning crew to their own fate."

I believe that this apparently heartless order is justified by the loss of the "Aboukir," "Cressy," and "Hogue," the only flock of ducks, figuratively speaking, that has come within the shot of the submarine torpedo gunner.

The conclusion must be reached, therefore, that on the high seas the only advantage the costly dreadnaught has over the pygmy, cheap submarine, as at present constructed, lies in its ability to run away and to rule commerce far offshore on the high seas.

The principal means used in my mine-avoiding submarine are the bottom wheels and diving compartment, which were incorporated in my 1893 design, which also carried my pioneer features of lateral hydroplanes to get even keel submergence; high, watertight superstructure, which is indispensable for high-speed, ocean-going submarines; anchors, and lifting and lowering sighting instruments. Excepting the bottom wheels and diving compartment, most navies have now incorporated these features in their submarines. Three navies have adopted the bottom wheels, etc. These mine-avoiding craft are able to enter the enemy's own territory with impunity and destroy his merchant ships and warships in their own harbors. The "Niger" was sunk at Deal by a German



When the submarine, traveling on the bottom, reaches the net, the latter is lifted by the projecting arms and slides over the smooth body of the boat.

Passing below protective netting.

submarine, which is reported to have passed through a mine field. In 1902 I built the "Protector" and fitted it with the above features.

In 1903, former President Taft, then Secretary of War, appointed a Board of Officers, consisting of Major (now General) Arthur Murray, as president of the board; Capt. Charles J. Bailey, and Capt. Charles F. Parker, who reported: "It will give the nearest approach to absolute protection now known to the board. . . . The boat can lie for an indefinite time adjacent to the point to be defended in either cruising, awash, or submerged condition, by its anchors, or on the bottom ready for instant use, and practically independent of the state of the water, and in telephonic connection with the shore, or can patrol a *mined or unmined channel, invisible to the enemy and able to discharge its torpedoes at all times*," and for the attack, "the boat shows great superiority over any existing means of attacking mine fields known to the board. First, it can be run by any field as at present installed, with but little danger from the explosion of any particular mine or from gun fire, during the few seconds it exposes the sighting hood for observation, and can attack at its pleasure the vessels in the harbor. Second and third, the board personally witnessed the ease with which cables can be grappled, raised and cut while the boat is maneuvering on the bottom; mine cables can be swept for, found, and cut or a diver can be sent out for that purpose."

Congress, however, failed to provide for the purchase of vessels of this type, although repeated recommendations were made by the general staff to do so; consequently, the "Protector" was sold to Russia, and is now at Vladivostok.

The necessity of such features as bottom wheels and diving compartment is now being brought out in the present war. I believe the mining and counter-mining features must be incorporated in one type before the submarine reaches its full development. The impotency of the great combined English and French fleets of battleships, cruisers, destroyers, and submarines must be galling to the people who have paid for them by the sweat of their brows. These fleets are impotent because the Germans will not come out from behind their mines and forts and wage an unequal battle against superior numbers, but prudently are sending out their submarines to destroy gradually the enemy that is trying to blockade the German ports.

Winston Churchill, the First Lord of the British Admiralty, expressed the bitterness of this impotency when he said, "If they don't come out and fight, we will go in after them and dig them out like rats"; however, the German mines and submarines stand in the way, and are themselves taking their toll of ships.

The mine-avoiding submarine can enter with comparative safety through a mine field, like a shuttle passing through the woof of cloth during the weaving process, and I take the opportunity to explain, for the first time, through the SCIENTIFIC AMERICAN, my method of entering harbors. To comprehend thoroughly the safety with which this is accomplished, it is necessary to appreciate the almost insuperable difficulty of discovering an object like a submarine vessel when once sunk beneath the surface of the water. There are many sunken ships containing valuable treasures and cargoes that lie along our coast, and in most of the harbors of the world, that have been known to have sunk within a radius of less than a mile from some given point, but which have never been located. Some of these vessels have been searched for for years and

never been found. Dozens of vessels have been sunk in the waters of the North and East rivers and never located. Perhaps the most noted case is that of the Pacific Mail steamer "Rio de Janeiro," which sank in the entrance of San Francisco Bay, with treasure of a value of over \$500,000. This large vessel went down in a fog only a short distance from land, but she has never been found. Some of the British and French submarines have been lost in localities well known, but it has been impossible to locate them.

During several years of experimental work with submarines, investigating bottom conditions, I have traveled many miles in the Chesapeake and Sandy Hook bays, along the Atlantic Coast and Long Island Sound, and later in the Gulf of Finland and the Baltic Sea, and it is a fact that cannot successfully be disputed technically, by any one, that a submarine of the type recommended by the United States Army Board may be taken into any harbor in the world entirely unseen and remain there, if necessary, for a month at a time,

the reason that the vessel would pump up and down with the rise and fall of the sea. Neither could the vessel lie at rest on the bottom as the lift of the ground swell in bad weather was sufficient, even with a considerable negative buoyancy, to cause the vessel to pound so badly that the storage battery plates would be destroyed in a few minutes. I, therefore, suspended the wheels on swinging arms and applied a cushioning cylinder. The hull of the vessel was then free to move up and down, synchronizing with the lift of the ground swell, and at the same time the weight of the wheels kept the submarine close to the bottom and able to keep her position while at rest or to be navigated over the bottom at any speed desired.

Most of our Atlantic Coast, Long Island, and Chesapeake Bay water-beds are comparatively uniform as to depths. In other countries I have navigated over rocky bottoms filled with giant boulders. A rough bottom limits the speed at which it is advisable to travel, but I have never seen a bottom so rough that it could not be readily navigated.

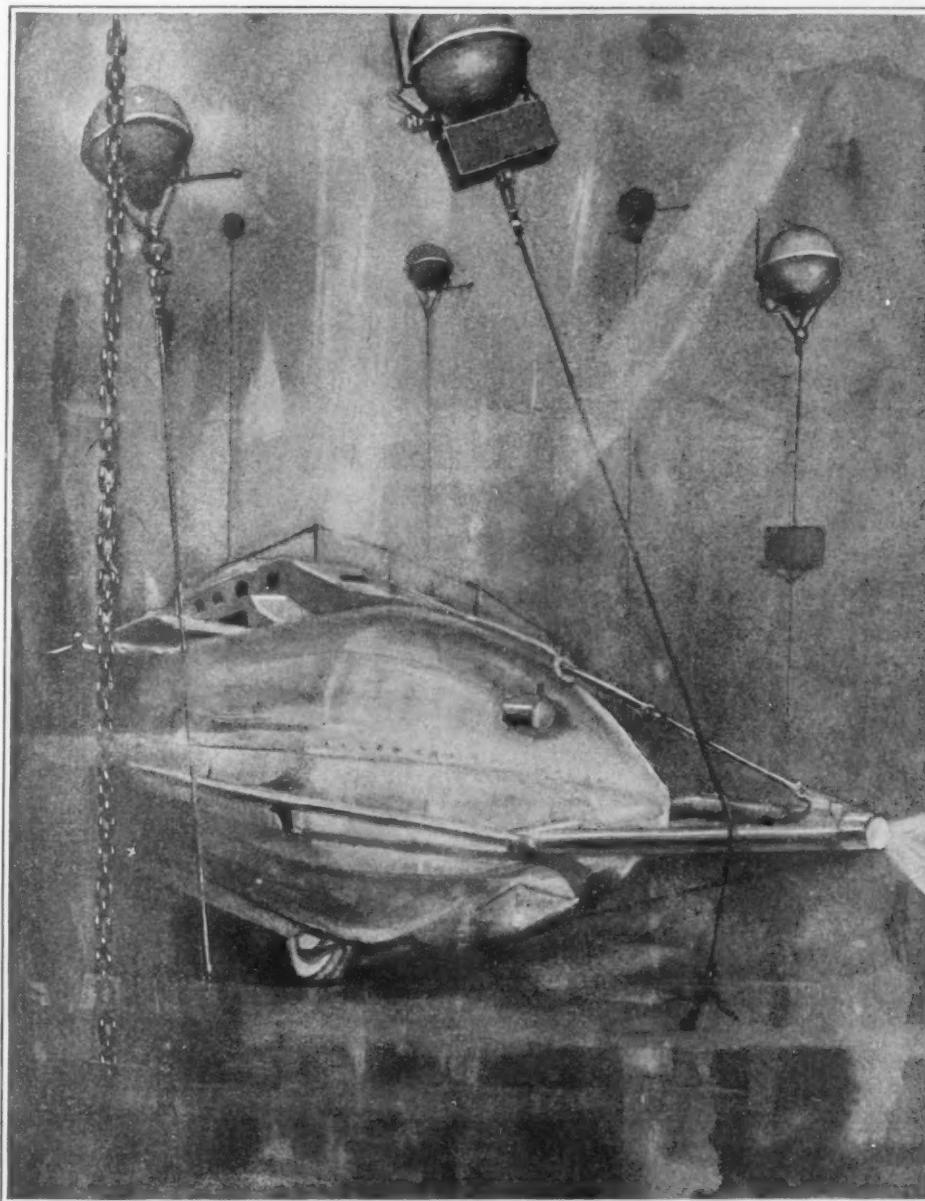
Lake boats, fitted with bottom wheels, have, in a competitive test abroad, entered land-locked and fortified harbors without discovery, where the entrance from the sea has been through a tortuous channel. All other vessels, except the one fitted with bottom wheels, were discovered long before reaching the outer fortifications, because it was necessary for them to show their periscopes to sight their way. They struck the sides of the dredged channel, which caused them to branch and be discovered, because they had to maintain a comparatively high speed to be kept under control. In tests carried out in Russia the boat fitted with bottom wheels simply wheeled along in the channel at slow speed and stopped and backed to change course at will. The revolutions of the bottom wheels gave the distanced traveled, the manometer gave the depth, and the compass the proper direction; consequently, with a correct chart as to courses and depths, navigation on the bottom in entering harbors is very much easier than on the surface, unless the channels are well buoyed.

Most mines, as at present installed, are either of the observation or contact type; the observation mines are fired usually from shore stations when the enemy is seen to be over them, while the contact mine is anchored a few feet beneath the surface and is either exploded by contact with the surface of the vessel's bottom or by the agitation caused by the rush of water due to the swiftly passing vessel. The

European belligerents have put out contact mines to protect their capital ships from the submarines. The dread of these mines is holding the submarines outside of the mined areas and the mines are, therefore, effective. None of the British vessels are fitted with bottom wheels and diving compartments, and they must be navigated at such speed to keep submerged control that they would explode a contact mine if either the mine or its anchor rope was touched. This also applies to some of my later boats, as the bottom wheels have been omitted to meet the demand for greater speed on the surface and submerged.

I am inclined to the belief that this has been more or less of a mistake, because the bottom wheeled submarine can go to and "dig" the enemy out of its base, in addition to hunting the big surface craft of the enemy on the high seas.

With the bottom wheels, navigation can be conducted so carefully over the bottom that inspection of the



A Lake submarine traveling on the bottom can push the anchorage cables aside by means of the guards attached at the bow.

#### Passing through a mine-field.

and destroy shipping, docks, and war craft deliberately and leisurely, and defy discovery.

My method of entering harbors or through mine fields consists principally in providing submarine vessels with bottom wheels and other component undisclosed details. When submerged, the vessel is given sufficient negative buoyancy so that she will not be drifted off her course by the currents when resting on the bottom. The vessel is what might be termed a submarine automobile, and it may be navigated over the bottom as readily as an automobile on the surface of the earth. The submarine automobile has one great advantage over the surface type in its ability to mount steep grades or go over obstructions, because the vessel is so nearly buoyant that she will mount any obstruction she can get her bow over.

My early experience proved to me that a submarine could not be satisfactorily navigated submerged in shallow, rough water by the same method of control as was found to be satisfactory in deeper water, for

(Concluded on page 74.)



On the trail to the mine in the crater.

## A Mine in a Meteor-Made Crater

### Work of a 15,000-Centimeter Celestial Projectile

By Arthur Chapman



Anvil rock at the bottom of the crater.

**U**NIQUE mining operations have been carried on, until recently, in the crater of what is known as Meteor Mountain, near Canon Diablo, Arizona.

This is not a volcanic crater, but was formed by the fall of a tremendous meteor in some past age. Scientists who have examined the crater are of the opinion that the meteor which struck the earth there must have been of almost incalculable size and weight. In fact, there is no indication anywhere else of the alighting of a meteor approximating the size of this Arizona visitor.

Acting on the theory that the meteor was of such great weight that it sank into the ground to an extreme depth, a mining company expended much money in driving holes at the bottom of the crater in a search for the main body of the deposit. Five shafts have been sunk at the bottom of the crater, the longest being 125 feet deep. Quicksands and silica, encountered at that depth, prevented further sinking. From the bottom of the deepest shaft borings have been run down to solid formation, but no trace of the meteor has been found.

Several years ago a sheep herder discovered some of the meteoric fragments and this led to further investigation, and it was found that the large hill rising from the level desert, near the spot where the herder had made his discovery, was the rim of a great crater. More fragments were found near this crater, and soon it became the generally accepted theory that a meteor caused the strange formation in the desert, which at first had been ascribed to volcanic action.

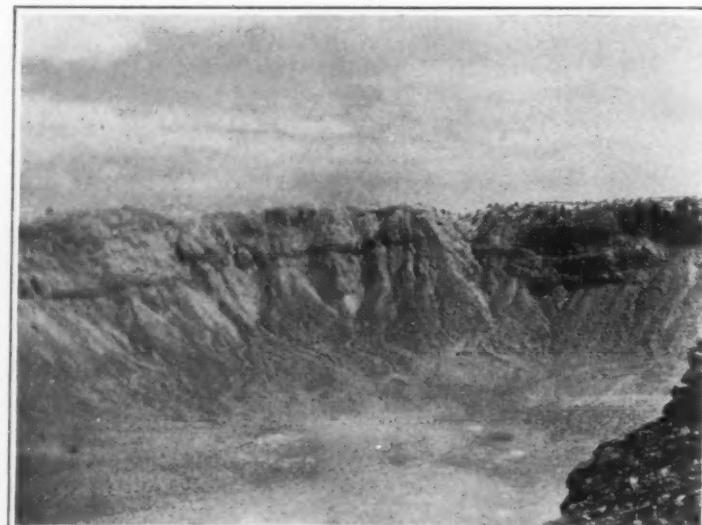
The hill itself does not deserve the term "mountain," as it rises hardly more than 150 feet from the level of the desert. The crater is three quarters of a mile across and is from 300 to 400 feet deep. There are 300 acres in the bottom of the crater, giving ample room for the mining operations which have been carried on.

So far as its shape is concerned the crater could have been formed equally as well by a blowout as by impact; but the character of a portion of the ejected material points strongly to an impact as the origin. The evidence afforded by other meteoric bodies, in regard to the results in impact and the disturbance of the surface of the earth, is very contradictory and is of little assistance in deciphering the gigantic disturbance here found, for nothing equaling it in size has ever been discovered.

This Arizona meteor must, by the evidence at hand, have struck with sufficient force to crush a layer of limestone 300 feet thick, having an average crushing strength of 12,505 pounds per square inch, and, further, of a layer of sandstone 500 feet thick with a crushing strength of 6,350 pounds; and to meet these conditions the hypothetical case is conceived of a mass of meteoric iron 500 feet in diameter and striking the earth at a speed of five miles a second. The superficial rocks are crushed and thrown back to an amount greater than the bulk of the meteor, and as a projectile under similar conditions will create a crater eight to ten times its diameter the supposed 500-foot projectile could easily have formed the 3,000-foot crater that exists in Arizona. As this huge projectile penetrated below the surface the upward escape of material around the mass would be impeded, and that directly in its path and also that on the sides would become greatly compacted. The heat generated by the rapid down-

ward passage of the body would produce fusion and probably also a partial volatilization and the effect of the impact would convert any moisture present into steam of great explosive power. The result would be that quantities of the surrounding material, together with portions of the meteor itself, would be ejected and thrown back over the rim of the crater and scattered over the surrounding plain. Such is a hypothetical reproduction of the event which would explain this curious crater and the conditions that surround it.

Meteor Mountain is ten miles from Volz's trading post at Canon Diablo, in the heart of the grim Southwestern desert, and is visited by few people. Yet it is one of the most interesting natural attractions of the Southwest. It is believed mining operations will be taken up again and that some way will be found to penetrate more deeply beneath the crater and ascertain whether the greatest of meteors is resting, as many believe, in a solid mass hundreds of feet below the level of the Arizona desert, or whether there is nothing left of the original body of the meteorite but the scattered material now found upon the surface.



The enormous pit produced by the impact and explosion of a giant meteorite.



Meteor Mountain in the background at the right.

### Slaughter in Mines Rivals War

**B**ECAUSE war is a comparative novelty and its horrors are presented to us in appropriate descriptive settings we shudder at its useless slaughter, entirely unmindful of the fact that much more unjustifiable killing is going on daily in our midst as the result of the manner in which some of our commercial enterprises are conducted.

The report of the Bureau of Mines, just issued, shows that during the year 1913, 3,651 men were killed in the mines and quarries of the United States, and the number injured during the same period is estimated at 100,000. This means that nearly three and one half men were killed for every thousand employed, which Dr. Joseph A. Holmes, director of the bureau, declares to be "excessive and unnecessary and a discredit to the industry." Commenting further, he says:

"When we consider that this record is being repeated year after year, the very thought of it becomes appalling. In the last three years, as far back as the records of the Bureau covering certain branches of the industry go, the mines and quarries of the United States have swallowed up 10,487 human lives and have incapacitated temporarily probably a quarter of a million men. And the saddest part of it all is that a great part of this death roll, and a still greater part of the injuries, are not necessary. I believe I am conservative when I say that half of the 3,651 men killed in the year 1913 might have been saved and three fourths of the 100,000 men injured in the same year might have escaped injury had all the various agencies involved, the operators, the miners, and the State and National Governments, done their full duty in the matter. Perhaps no one of these agencies has done its full duty. For the Bureau of Mines, as representing the Federal Government, I can say that, owing to a lack of adequate funds, this Bureau has fallen short of doing its full part in this great safety movement; and I therefore hesitate to criticize the seeming shortcomings of any other agency."

These employments, from their nature, must always be hazardous; but the record of European countries of only one man per thousand killed in similar work shows that the above estimate of the easily possible saving of life can and should be realized.

### Marconi Company Wins Again

**I**N the suit of the Marconi Company against the DeForest Radio Company and the Standard Oil Company for infringement of certain Letters Patent, in which Judge Hough recently granted the Marconi Company a preliminary injunction, the Court has handed down another decision. It appears that subsequent to the former decision the defendants moved to suspend the injunction pending an appeal, in so far as it related to the boats of the Standard Oil Company, and also another motion to vacate or modify the injunction with respect to both the defendants. These motions were brought upon additional affidavits, but Judge Hough, in a decision filed recently, denied all of the motions, thus refusing to suspend the injunction as to the Standard Oil Company, and to vacate or modify the injunction as to both defendants.

### Unprecedented Accident to a Torpedo-boat Destroyer

THE two photographs herewith presented show the result of a boiler explosion which came very near sending one of our latest destroyers to the bottom. The destroyer concerned was the "Aylwin," one of the latest to be designed and built for the United States Navy. This fine vessel and those of her class are about 300 feet in length on the water-line, 30½ feet beam, and 8½ feet draught. Their displacement is about one thousand tons and their speed 29 to 30 knots. The accident was not due to any defect in the vessel itself, but resulted entirely from a defect in the new type of boiler which had been installed on this vessel. The boilers are of the water-tube type, and it was the right-hand lower drum which gave way, the drum being blown off against the ship at about the turn of the bilge. The heavy blow thus struck, together with the pressure developed by the large amount of water which suddenly flashed into steam, served to tear open the starboard side of the boiler room and to produce the extraordinary rent which is shown in our view of the "Aylwin" when she was in drydock for repairs. The accident occurred in the forward boiler room and to the forward boiler of two which occupied this compartment. The explosion caused a leakage in the after boiler room bulkhead, so that two compartments were filled, with the result that the draught increased from 8 feet 5 inches to 13 feet 6 inches. The serious nature of the accident was aggravated by the fact that there was a heavy head sea running off Cape Hatteras, where the explosion took place; and the working of the water within the ship caused a considerable working of the engine room bulkheads, which the officers and crew endeavored to correct by bracing the bulkheads with wood and the furniture of the ship.

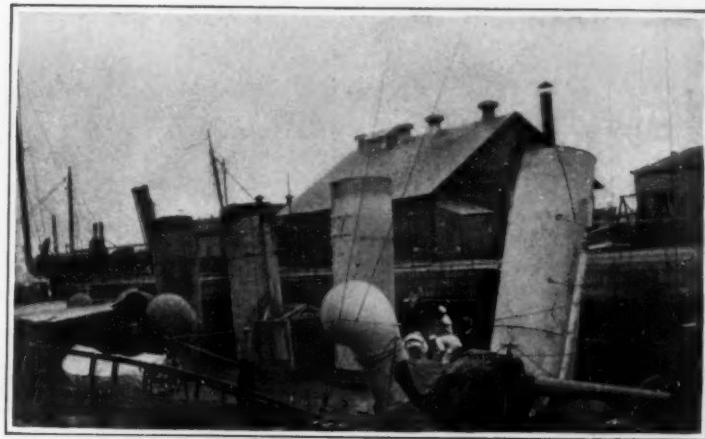
The wounded were conveyed to another destroyer, which took them at 30 knots' speed to the nearest hospital. The "Aylwin" was taken in tow and, in spite of her seriously damaged condition, was brought safely to Newport and placed in drydock.

### Cutting Up a Bridge With the Oxyhydrogen Torch

IT is well known that the oxyacetylene or oxyhydrogen torch is very useful in cutting up old structural iron work that has to be removed in sections; for it provides the easiest and quickest way of cutting through the material. Ordinarily the metal has to be "pre-heated" to the point of ignition when it is actually burned by combining with the oxygen. Ordinarily the "pre-heating" of the metal is continued during the entire process of cutting. However, there is a system in use in Germany, in which the work is merely started with the oxyhydrogen flame, and once the metal has reached the proper temperature the cutting is continued to the end by supplying it with oxygen alone.

This process is illustrated by heating a piece of iron wire in the flame of a Bunsen burner and then sending a stream of oxygen upon it, when the iron will be found to burn with brilliant sparks. A special form of blow pipe has been devised to carry out the same principle on a large scale. First, tubes lead in oxygen and hydrogen to produce the pre-heating flame, and then means are provided for cutting off the hydrogen and permitting the oxygen alone to strike the glowing spot. This results in melting the metal and cutting it rapidly.

The accompanying photograph shows the work of one of these torches in cutting up an old bridge over the Rhine at Cologne. The upper part of the structure was first cut up into short sections, which were removed one after the other, leaving the floor structure intact. After that a pair of caissons were floated under the floor and when the latter had been cut free with a blow pipe water was pumped out of the caissons, permitting them to



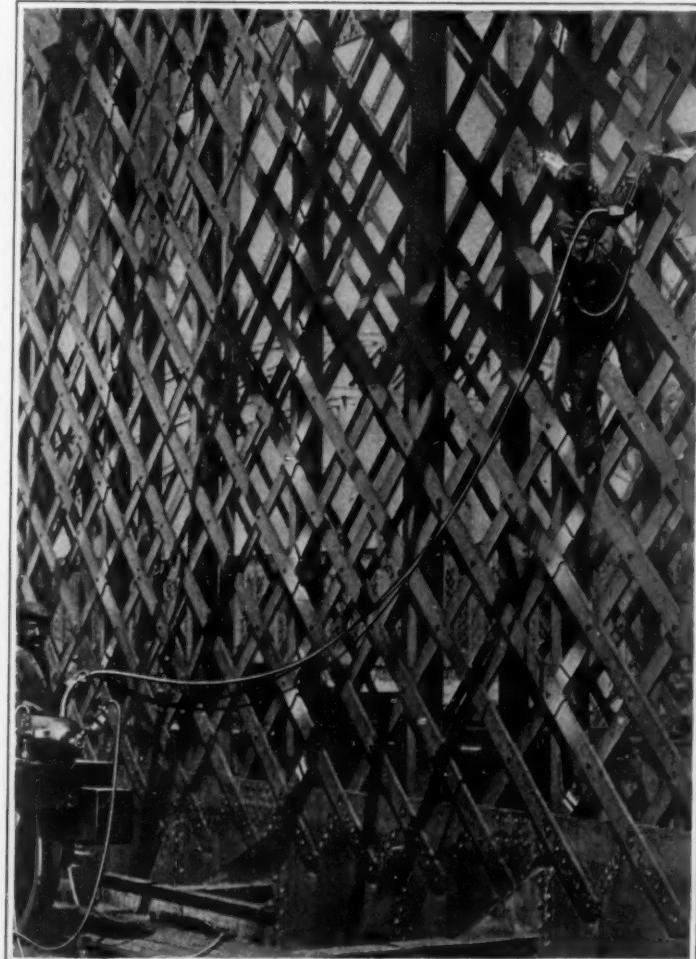
Destroyer "Aylwin," showing smokestacks displaced by explosion.



"Aylwin" in drydock, showing a strip of her side, 15 feet wide, blown outward by the boiler explosion.

rise and lift up the structure. Thereupon, it was successfully transported some distance down the river and finally landed on a neighboring bank.

Here the floor of the bridge was further cut up into small parts by the use of the oxyhydrogen torch.



Cutting up an old bridge over the Rhine, at Cologne, with the oxyhydrogen torch.

### Our Beginnings in Camphor

A DOZEN years ago the Government was distributing broadcast throughout Florida a bulletin of immense import, setting forth the excellent results of a prolonged series of experiments in camphor-raising in this mild climate, and urging that every citizen of the peninsula, whether rural or urban, should set out as many camphor trees as the ground around his home would allow. If all one's ground space should be taken up with food and fruit plants, the argument proceeded, still there were the walks and roadways to be lined. And what more beautiful, symmetrical or delightfully umbrageous than the vividly green and gracefully branching camphor trees?

The realization had come home to our nation, about that time, with especial force and significance, that Japan had a monopoly of the camphor trade; hence, a monopoly of one of the most important sinews of war.

The propaganda waged at that time, both by bulletin, by experiment stations, and agents from the Bureau of Plant Industry, is at last showing fruitage. The camphor plantation at Satsuma, Fla., began recently the distilling of the present year's "crop," and the yield promises to be enormous. This is the first and only bearing plantation of any size in the United States. Its initial effort at distillation was made last season, over 10,000 pounds of crude gum being turned out.

The present year's yield promises to be many times that amount. There are over 2,000 acres in trees, and it is expected that 500 additional will be set during this winter.

Other smaller plantations in different parts of the State will shortly come into bearing and many others will soon be set out. Besides this, countless small farmers and truck growers have a few rows of these valuable trees or a border of them around their fields, and, as the business progresses, the crops from these will either be regularly distilled at home or else hauled to community "stills." The outlook now is that within another dozen years or less the camphor trade of the United States will be revolutionized. The monopoly of Formosa will be a thing of the careless past.

### Iceland's Railway

FOR years the people of Iceland have been planning to build a railway on their island and at last their hopes have been realized. The Althing, or Iceland Congress, has passed the bill, and at no very distant date the steed of steel will worm its way between the glaciers and among the hot springs of Iceland.

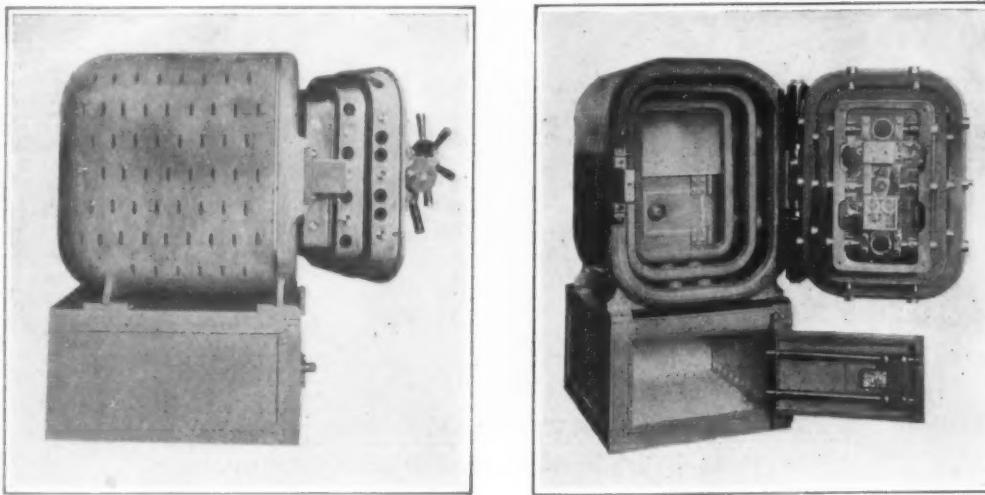
The main line of this railway will run from Reikjavik, the capital, to Thorsjaa; here the road will divide, with one branch to the geysers and the other to Oerbak. The total distance to be covered by rail is about 100 kilometers, or about 62 miles, and the system is to cost approximately \$1,000,000. At the present time the facilities for traffic and trade are still most primitive. Travelers are obliged to ride on any animal which may be available, while freight is moved in rude carts. The roads are for the most part very bad and they are often made impassable by mountain torrents.

### Early Use of Pilot Balloons

A NOTE in the *Monthly Weather Review* calls attention to the fact that the famous exploring expedition sent out by the French government under La Pérouse in 1785 carried a few small balloons, some of paper and some of goldbeaters' skin, for use in studying the winds in the upper atmosphere, and that the instructions prepared for the expedition by the Academy of Sciences pointed out the special importance of using these balloons in the trade-wind region in order to ascertain at what altitude the direction of the wind changes in that region. Thus the recent soundings of the trade winds carried out under the direction of Prof. Hergesell appear to have been anticipated by more than a century.

**Explosive-proof Safe**

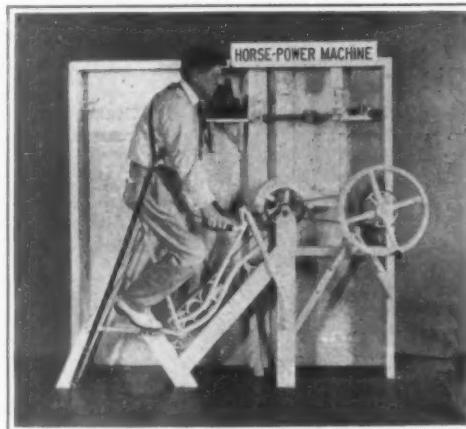
UNLESS he is provided with an oxyacetylene or oxyhydrogen torch, a burglar will find great difficulty in opening the safe shown in the accompanying photograph; indeed, the task may be considered well-nigh impossible. The safe is constructed with three walls of manganese steel, the outer and middle walls being perforated, the inner walls solid. These walls are separated by air spaces. The perforations in the outer walls do not register with those in the middle wall, so that it is impossible to work a drill through from the outside to the solid interior wall. There are three doors of manganese steel, one for each wall, each with its own set of bolts, and all arranged to swing on a single hinge. The object of perforating the walls is to preclude the possibility of confining gases generated by explosives and thus thwart the bank robber who depends upon blowing open a safe with nitroglycerin. To prove the efficiency of this safe, a test safe was made of soft steel with its door held in place by  $\frac{5}{8}$ -inch cap screws in place of the regular bolts. Five and a half ounces of nitroglycerin were exploded behind the outer walls of the safe without doing any damage, and after the explosion the door opened freely.



Safe constructed with perforated outer walls to prevent confining of gases generated by explosives.

**The Horse-power of a Man**

THE superintendent of a sanitarium in Battle Creek, Mich., has invented an apparatus for testing the strength of his patients and recording it in terms of horse-power. The machine consists of a bicycle with its front and rear wheels removed and its sprockets geared to a brake wheel. Straps run over the shoulders of the individual whose strength is to be tested and are attached to the floor. This enables him to use more power on the pedals. In the test he is required to keep the machine going at a predetermined rate. While he works the brake is gradually applied on the brake wheel, until the friction load is such that the rider is unable to "make the grade." The period at which he is forced to give up determines the horse-power he is able to develop. With this machine it has been shown that the average horse-power of a normal man is one fifth and that of a woman one tenth.



Testing the horse-power of a man.



Bicycle converted into a motorcycle.

top is shown a saw before use.

**Auxiliary Motor Wheel for the Bicycle**

ANY bicycle may be converted into a motorcycle in a few minutes by attaching the motor wheel illustrated in the accompanying engraving. It consists of a compact power plant mounted on a small wheel fitted with a heavy motorcycle tire. It furnishes enough power to carry the rider a hundred miles on a single gallon of gasoline. The motor is a one-cylinder four-cycle engine with high tension magneto and carburetor. The driving gear and gasoline tank are also carried on

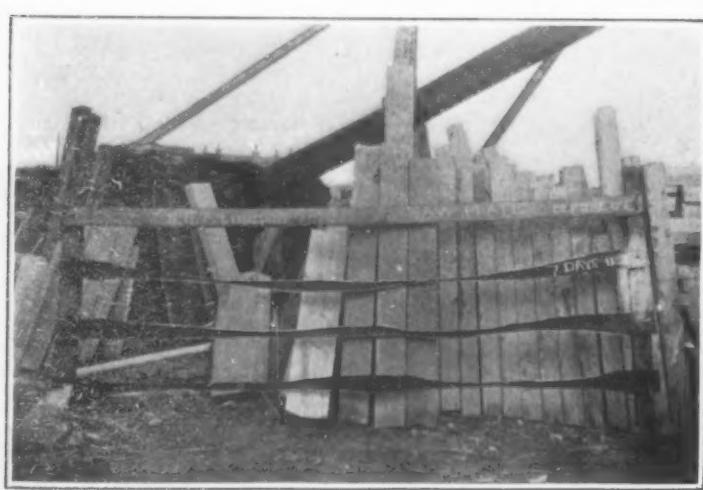
the motor wheel. The motor is controlled by a lever attached to the handlebars, and both bicycle and motor are therefore under perfect control of the rider. The device may be very quickly attached to the bicycle frame beside the rear wheel.

**A Gasoline Switching Locomotive**

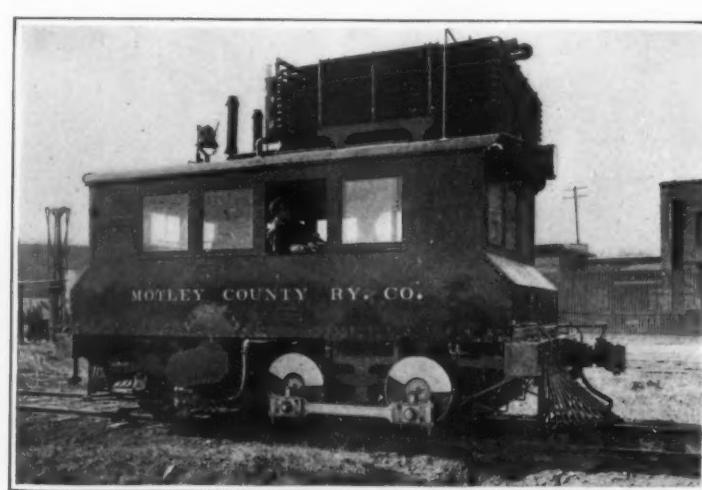
IN some places it is considered a luxury to use a switching locomotive because of the expense of maintenance and the consumption of fuel while the locomotive is not in service. Hence, unless there is enough work for the locomotive to do the twenty-four hours of the day the work of switching is done by the engines of freight trains. In order to provide a suitable locomotive for such conditions, in which there will be a minimum of expense for operation and no expense during the idle hours of the locomotive, a gasoline switching engine has been designed and is now in use at Matador, Texas. A photograph of this locomotive is shown herewith. It has a 300 horse-power engine and exercises a tractive effort of 12,000 pounds, at six miles per hour. The engine is of six-cylinder type, with cylinders 11 by 15 inches. The power transmission, which is pneumatically operated, is effected by means of a sprocket on the crankshaft connected by chain to a sleeve working free on the rear driving axle and is then transferred under multiple disk friction-clutch to the forward driving axle, where, by an octaroon clutch, the power is either magnified by a series of gears to produce heavy tractive effort and high torque for starting processes, or is delivered direct to the driving wheels. Once the locomotive is in motion the gears are cut out, and it is operated by the direct connection.

**Holding Tacks for Driving**

IT is usually found difficult to hold a small tack in place for driving, and this is especially true for round-headed tacks or small nails. M. Rene Engel of Paris uses an ingenious holder which anyone can make. Take a strip of sheet metal and cut a narrow slot in one end just large enough to allow a small nail to pass in easily, then fold the strip at the middle so that it takes the shape of a pair of pincers. The tack is placed in the slot so that the head can be gripped by the pincers, and the tack thus held firmly can be placed at the desired point in the wood. Striking the top with the hammer drives in the tack, then the piece is removed and the tack driven home.



Toothless saws for cutting stone.



A 300 horse-power gasoline switching locomotive.

## RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

## Pertaining to Apparel.

BRACELET.—C. F. TROMMER, 30 W. 36th St., New York, N. Y. This bracelet is formed of sections connected with each other by normally concealed means which allow the bracelet to enlarge in diameter when pushing it over the hand onto the wrist, and to then contract automatically when reaching the wrist, so that the bracelet is not liable to accidentally slip off the arm and become lost.

SHOE HEEL BURNISHING WHEEL.—C. J. STRAESSLE, Box 577, Lynn, Mass. It is the design of this invention to provide a burnisher in which an annular burnishing means on the exterior of the wheel is adapted to yield and to automatically conform to the curvature of the heel at the point of contact.

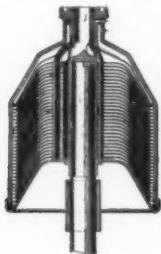
SHIRT.—L. D. LIVINGSTON, 547 Broadway, New York, N. Y. The invention provides useful improvements in shirts, notably shirts made of silk, mercerized cotton and other soft materials, and whereby the bosom portion at the collar bone of the wearer is protected against undue wear and soiling, thus insuring long life to the shirt.

PUTTEE.—A. D. MOLONY. Address care of Day, Davies and Hunt, 321 High Holborn, London, W.C., England. This invention has for its object, *inter alia*, to add comfort to all forms of puttees for hard wear, especially military, without diminishing their strength; and to adapt puttees, as nearer, more efficient and comfortable articles of wear, to many new uses, chiefly sporting, for which the garter or combination of Highland spat and stocking have been worn hitherto.

## Of Interest to Farmers.

COTTON CHOPPER.—F. ANDERSON, R. F. D. No. 1, Lindsborg, Kan. In this invention a chopping hoe is given a rotary parallel movement transverse to the direction of travel of the machine, in which the hoe and its operating means are mounted to be shifted laterally in either direction, and also to be rocked in a vertical plane without breaking the driving connection with the actuating means.

CREAM SEPARATOR.—F. A. FALK, Stacyville, Iowa. Mr. Falk's invention comprehends an improved construction of separator making use of centrifugal force, the various movable parts of the separator being so arranged as to



CREAM SEPARATOR.

render the separation as nearly positive as possible, and to prevent the mixture of the cream with the heavier portions of the milk after the separation of the cream therefrom.

## Of General Interest.

WATERPROOFING COMPOSITION.—F. MONFORTE, Box 267, Otisville, N. Y. An object here is to provide a composition which will render leather, such as that used for shoes, boots and the like, waterproof. The composition of matter provided will render leather waterproof, while possessing ingredients which tend to prolong the life of the leather.

REMOVABLE SUPPORT FOR SIDES OF CONCRETE MOLDS.—D. W. DALEY, 1221 Lynn St., Parkersburg, W. Va. In molding the walls of concrete or cement structures it is necessary to support horizontally and at different heights the side boards of the molds between which concrete or cement is to be poured to form a section of the wall. The inventor's improved apparatus carries out this purpose.

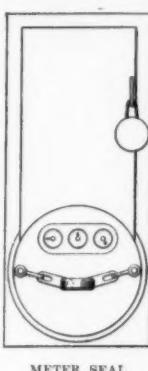
CULVERT.—W. H. FRANKLIN, Box 608, Red Lodge, Mont. This device is composed of reinforced cement or plastic material capable of hardening and of sectional form, the sections and the reinforcements being so constructed and arranged that the sections may be rigidly connected together to provide for culverts of various lengths.

HORSE OVERSHOE.—C. A. DEUSCHER, 223 St. Ann's Ave., Bronx, N. Y., N. Y. In this invention horse overshoe plate is provided of peculiar and simple construction, the same having secured thereto in a rigid permanent manner a plurality of lugs or ears serving as connecting means for the overshoe.

CATHETER CASE.—O. B. SCHELLBERG, 1058 Southern Boulevard, Bronx, N. Y., N. Y. An object here is to provide a case in which the catheter may be inclosed and the whole subjected to a sterilizing heat, whereby the catheter will be effectively sterilized and may

be maintained and carried in a sterilized and aseptic condition until required for use.

METER SEAL.—J. G. GOREN, care of M. Bretz, 747 10th Ave., New York, N. Y. This invention relates to improvements in seals, and particularly to seals for meters, and has for an object to provide an improved structure which



METER SEAL.

must be destroyed before the meter can be opened. Another object is to provide a seal which can be readily applied and also readily removed by breaking, the structure being such that the broken parts cannot be disengaged.

## Hardware and Tools.

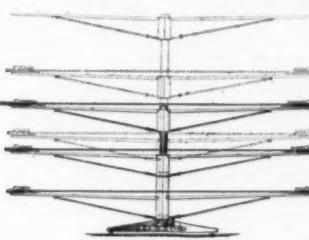
SAFETY RAZOR BLADE HOLDER.—R. E. BROWN, care of American Home Co., Olean, N. Y. This device is for use for holding a safety razor blade during the operation of honing or stropping the blade. Safety razor blades are exceedingly difficult to handle without danger of accident, and the difficulty is increased because of the fact that the honing and stropping of the blade are done quickly. The invention overcomes this difficulty.

## Heating and Lighting.

ELECTRIC STOVE.—W. V. HARDY, Indianapolis, Ind. The purpose here is to provide a device especially adapted for heating press boxes, and wherein the arrangement is such that the stove may be placed within the box to heat the same, and wherein the box is provided with heating elements supported out of contact with the box.

## Household Utilities.

CLOTHES REEL.—J. T. PILKINGTON, Route 4, Armstrong, British Columbia, Canada. Each endless line carried by the respective sets of arms can be entirely filled with clothes from a doorway or other convenient position by merely lowering the arms by means of the reel



CLOTHES REEL.

until the uppermost set of arms are lowered enough to be easily reached. The reel is then turned until the top set is raised above the doorway and the second set brought into use, and so on.

DUST PAN.—A. E. GLOTFELTY, 229 South 9th St., Connellsville, Pa. This pan is of substantially double construction, capable of being operated by either a right or left-handed person. Its working edge is disposed at an angle to its ends, so that the pan may be readily manipulated in the corners of a room or floor. The bottom of the pan is provided with corrugations disposed at an angle to the working edge and directed toward one of the forward corners of the pan, so that dirt contained on the pan may be readily concentrated toward that corner to facilitate rapid dumping into a small receptacle. Means provide for preventing loss of dust from the bottom and for the removal of dust from the same.

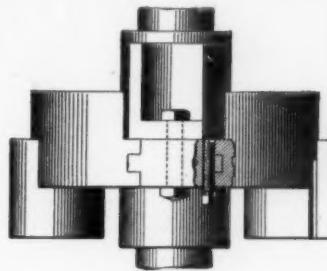
TABLE.—G. D. TOLMAN, Address R. L. Clark, 157 Main St., Oshkosh, Wis. The aim in this case is to provide a table of the folding type wherein the supporting legs are foldable closely upon the body of the table to permit the table to be stored in small space, and wherein mechanism is provided for holding the legs in extended position firmly and rigidly to provide for a rigid table.

MOP.—W. H. ZACHRY, care of Atlanta Variety Works, 90-92 Humphries St., Atlanta, Ga. One of the principal objects of this invention

is to provide an improved reversible mop head and one which is adjustable with relation to the handle. Another object is to provide means for detachably securing yarn or other mop material to the mop head.

## Machines and Mechanical Devices.

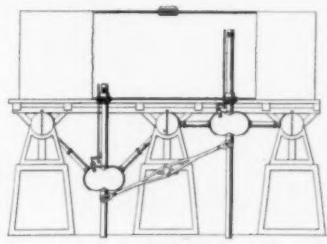
INTERCHANGEABLE CUTTER HEAD.—J. M. CRAWFORD, 1200 Missouri St., El Paso, Tex. This cutter head is designed especially for use in sash and door factories where many designs for sticking and many thicknesses of stock are used. This cutter head will work in the stock department or on stock work just the same as any other cutter head, but is designed



INTERCHANGEABLE CUTTER HEAD.

especially for special order mills or departments where it is necessary to carry a large number of cutter heads to meet the requirements. To every design of sticking and every thickness of stock there must be a cutter head, or on an average of from 10 to 12 to the machine. With the present head only one is needed.

PUMP.—J. E. WEAVER, Box 272, Twin Falls, Idaho. This invention relates to pumps and has reference more particularly to balanced compound pumps of the reciprocating type provided with translating plungers and swinging reciprocating members. An object is to provide a simple, strong, durable, and efficient



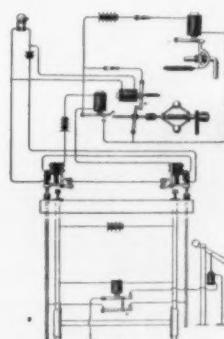
PUMP.

pump in which the power required to pump liquid is reduced to a minimum by balancing the moving parts of the pump. The engraving represents an elevation of an embodiment of the invention partly broken away to show the details of construction of the translating plungers.

REFRIGERATING MACHINE.—J. F. HAWLEY, 341 South Morengo Ave., Pasadena, Cal. In this apparatus the refrigerating medium is dry air, cooled by the evaporation of water, alcohol, or other suitable volatile liquids, in accordance with the degree of refrigeration desired, and wherein the rarefied current of cooled air may be used directly or indirectly, as for instance, in a container or in a cooling coil, in the usual refrigerating and ice-making machine.

## Hallways and Their Accessories.

AUTOMATIC TRAIN STOP SYSTEM.—E. G. MASCARENHAS, Rue Direita, Juiz de Fora, Brazil. This train stopping apparatus is adapted for use in connection with a block signal system, whereby a train is automatically stopped or slowed down or a signal given when



AUTOMATIC TRAIN STOP SYSTEM.

a train enters a block already occupied by another train and a stop signal is disregarded, or when the train travels at excessively high speed or when part of the circuit is interrupted or deranged for any reason.

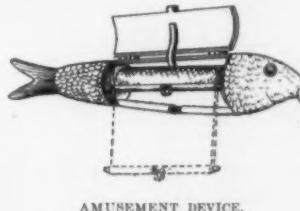
DOOR OPERATING MECHANISM.—W. E. HARRIS, care of D. J. Landers Lumber Co.,

Lebanon, Mo. This door operating mechanism is especially adapted for freight car doors, or other doors of like character, arranged to slide over and away from over the door opening, wherein a track bar is provided pivoted intermediate its ends for swinging movement, the door being mounted to run on the track bar.

CAR COUPLING.—H. R. SWAN, Sr., 938 Fifth Ave., Huntington, W. Va. The invention provides an arrangement, including details of construction, whereby a gravity latch member may be utilized upon the tail of the knuckle and the parts moved to and from closed position without the destructive friction and danger of breakage existing in couplers at the present time, and it further provides a connection by means of which the latch members when raised will be automatically held in such position.

## Pertaining to Recreation.

TOY.—B. O. WAKEFIELD, Rogers, Ark. This invention is a toy or amusement device, having preferably the form of a diminutive carp or sucker, and adapted to be worn as an appendage of a watch chain or as a badge or carried in the pocket. A ribbon is wound on a



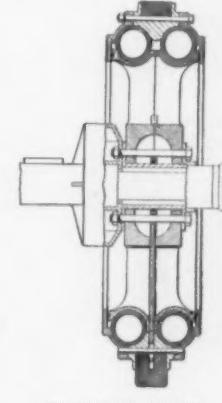
AMUSEMENT DEVICE.

roller or a drum journaled in the hollow body of the device, and, in practice, it bears photographs or other pictures of persons, landscapes or other things, or is provided with printed matter of any desired character.

## Pertaining to Vehicles.

LIQUID GAGE.—W. H. HOUT, Warrensburg, Mo. The inventor provides a gage for use with automobiles and like vehicles, for indicating the amount of gasoline or other fuel in the tank, and wherein mechanism is provided for permitting a correct reading to be made, regardless of the shape of the tank and amount of fuel in the tank, and wherein the indication is made in liquid measure, and showing the exact amount in such measure at any time instead of indicating the depth of the fuel in the tank.

PNEUMATIC WHEEL.—J. LAUB, Jr., 676 Main St., Oshkosh, Wis. In this case the invention is an improvement in pneumatic wheels, and has for its object to provide a wheel of the character specified, having pneu-



PNEUMATIC WHEEL.

matic tires so arranged that all of the resiliency of the tires may be utilized, while at the same time the tires are perfectly protected from injury, and from the actual wear due to contact with the road surface.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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## Eliminating the Coal Range from the Kitchen

(Concluded from page 64.)

towns, though in some localities the rate is higher and in some much lower. On this basis, therefore, you can with ordinary devices purchasable at any "electric store," at a cost of one cent for current:

- (a) Toast ten slices of bread.
- (b) Make three cups of coffee in an electric percolator.

- (c) Bring one quart of water to the boiling point.

- (d) Operate an electric broiler six minutes, an electric griddle eight minutes, a "radiant" grill for ten minutes, or a 4-inch disk stove for twelve minutes.

So much for the cost of operating separate portable devices. With a modern "electric range," however, suitable for a moderate-sized house or apartment, the cost of properly planned meals may be much reduced, bearing in mind the fact that the heat is applied only where needed and when needed.

Take, for example, the following:

Roast chicken with browned potatoes. Baked bananas with rice. Asparagus au gratin. Blueberry cottage pudding.

This meal, at the rate mentioned, may be cooked in the oven alone at a cost of 24 cents, and with fruit, salad and hard sauce for the pudding leaves little to be desired in the way of variety or edibility.

One of the most interesting illustrations of the possibilities in this connection is afforded by ocean-going steamships, and Uncle Sam has not been remiss in "trying out" electric cooking methods in some of his big boats with the most satisfactory results.

A recognized authority says in this connection: "All the handling of fires, of coal and ashes or oil, if done at all, should be done where it belongs, down in the boiler room, not in the galley; and by the stoker, not by the cooks."

Here the question of reliability is of prime importance, and that it has been solved to the satisfaction of the naval authorities is shown by the fact that the U. S. battleship "Texas" recently sailed from New York for southern waters equipped for electric cooking exclusively, the crew consisting of 300 men and 70 officers.

A sample menu for one day is of interest and follows:

**Breakfast:** Baked pork and beans, cornbread, coffee.

**Dinner:** Fried fish, tomato sauce, mashed potatoes, mince pie, bread, coffee.

**Supper:** Clam chowder, cheese, cold slaw, fruit, bread, tea.

Evidently Uncle Sam's boys are not expected to go hungry, as the "fried eggs" item allows for 180 dozen and the bread averages 6,300 pounds per week, exclusive of that supplied the officers' quarters.

Aside from the actual cooking equipment, which has proved most satisfactory, electric dough-mixers, coffee grinders, meat choppers, knife grinders, washing machines, dish dryers, etc., are used, and when we realize that the ship is steered, the turrets turned, guns trained, engine-room orders given, ammunition hoisted, the entire ship lighted and a hundred other things done by electricity, we cannot wonder that this is called the "electric age."

## Submarines That Are Strictly Invisible

(Concluded from page 69.)

course can be made, if desired, foot by foot, as progress is made, and all mines can be avoided.

The diagrammatic sketches illustrate the Lake method of operation in cutting cables, evading mines, planting counter-mines, clearing away mines or passing under chains, cables, and nets that may be stretched across the entrances of the harbors, to effectively stop the progress of surface vessels and submarines not fitted with bottom wheels.

If the commander of a submarine recognizes that the first principle of successful submarine raiding is to never betray his position by exposing his periscope while under way when within sight of the

## LEGAL NOTICES

# PATENTS

If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

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**Inquiry No. 9392.** Wanted the name and address of manufacturer of a machine to print and label lead pencils and pen-holders.

**Inquiry No. 9400.** Wanted to buy an insoluble, non-fusible and opaque plastic material to be used in die molds for manufacturing tobacco pipes of special kind.

**Inquiry No. 9401.** Wanted the name and address of the owner of a second hand aeroplane motor from 20 to 30 H. P.

**Inquiry No. 9403.** Wanted the name and address of a manufacturer who can blow a small glass article to order.

**Inquiry No. 9406.** Wanted the name and address of a manufacturer who can supply insole material in rolls. The material seems to be scrap leather composed and attached to a canvas bottom.

**Inquiry No. 9407.** Wanted the name and address of some patented mechanical device which saves money or time or both, which if properly handled will bring a large demand. It must not be too expensive. It may be electrical as well as mechanical. A first class article desired.

**Inquiry No. 9408.** Wanted the name and address of a manufacturer or distributor of a machine which will clean out single and double burlap bags; especially heavy bags.

**Inquiry No. 9409.** Wanted to secure a patented device which can be manufactured at small cost and around which a good business could be built.

**Inquiry No. 9196.** Wanted the names and addresses of makers of furnaces for reducing carbonate of barium to oxide, electric or otherwise.

**Inquiry No. 9399.** Wanted the name and address of workers in ornamental polished stone.

**Inquiry No. 9404.** Wanted the name and address of a manufacturer of a tool for cutting nicks in plate glass used for name plates and house numbers.

**Inquiry No. 9405.** Wanted the name and address of a manufacturer who is able to supply an attachable cydelt, aluminum or celluloid through which a snap fastener would work.

**Inquiry No. 9410.** Wanted the name and address of manufacturers of "Scuff Shoes."

**Inquiry No. 9411.** Wanted the name and address of a gas lighter using some form of platinum black which ignites by holding over a flow of gas.

**Inquiry No. 9412.** Wanted the name and address of a manufacturer that makes machinery for making bichromic ribbons for typewriters.

**Inquiry No. 9413.** Wanted the name and address of a manufacturer of calendar clips for pencils or pens. Minimum pad team same as large calendar pads.

**Inquiry No. 9414.** Wanted the name and address of a manufacturer who will make an armchair with an adjustable foot rest.

**Inquiry No. 9493.** Wanted the name and address of someone who has an article which could be made in a large Hickory Handle plant.

**Inquiry No. 9394.** Wanted the names and addresses of firms that deal in machinery for manufacture of plaster of Paris and drying by hot air.

**Inquiry No. 9395.** Wanted names and addresses of manufacturers capable of manufacturing cloth Boards (made of paper, wood, and metal) also sample books. One who is able to turn out unlimited quantities at right prices.

**Inquiry No. 9397.** Wanted the name and address of a manufacturer of a machine that will automatically dose and fold powders and other preparations.

**LATHES AND SMALL TOOLS****The "BARNES" Positive Feed****Upright Drills**

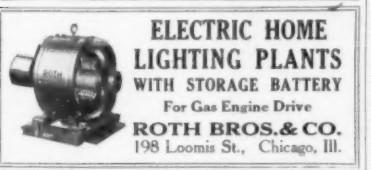
10 to 50-inch Swing  
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enemy, his vessel becomes invulnerable because it is invisible; for no one can attack an unknown, invisible object. The submarine vessel is then invincible because all the science of naval architecture has not thus far been able to devise a protection against the mine and torpedo.

The suggestion has been made that battleships might be kept from destruction by the use of armor placed on the bottom, as well as on the sides of the ship, or that a ship might be minutely subdivided so that she would remain afloat even if torpedoed. Mr. R. H. M. Robinson, who, as a naval constructor in the United States Navy, had charge of the design of all our modern battleships, up to and including the "Pennsylvania," is the authority for the statement that extensive experiments have been made in this country which show that, up to now, it seems impossible to provide adequate protection to a capital ship against torpedoes or mines by either arming the bottom or subdividing the hull.

**Where the Smoke Helmet Would Be Invaluable**

(Concluded from page 65.)

air, which includes the smoke and flame, rises, and cool air flows in along the floor to take its place.

In the best and most useful helmets provision is made for a supply of air, to be carried by the wearer, so he can enter and remain in any atmosphere. In some cases a tank of compressed air is carried. In other devices either tanks of oxygen are provided, or an apparatus for generating oxygen. In these cases provision is usually made for removing the carbonic oxide from the breathed air and adding fresh oxygen as required. It has also been proposed to use a tank of liquid air with these helmets. When equipped with helmets supplied with oxygen, it has been found possible for men to remain in the worst atmosphere for five or more hours at a time, and, as has been said above, these outfits have proved successful and indispensable in practical use.

In this connection attention may be called to certain forms of hand fire extinguishers which contain chemicals that liberate dense volumes of chlorine gas which stifle the fire; but this gas is equally effective in stifling life, and is, in addition, a dangerous poison. Whether extinguishers of this kind added to the horrors of the subway fire is not known, but the use of this class of extinguishers in confined spaces where human beings are present would justify action by the criminal courts.

The condition of unpreparedness for such a disaster as exists in New York probably also exists in many other cities, where so-called investigations of smoke helmets are being conducted; but if the officials would apply to the U. S. Bureau of Mines, all necessary information, and that of an impartial and expert character, could be promptly obtained.

**Quack Tree Surgeons**

SO many quack tree surgeons and tree repair fakers have sprung up, to the detriment of fine trees that might have been saved by competent treatment, that the Massachusetts Forestry Association has arranged to inspect and advise as to the proper treatment required by any shade trees belonging to its members without charge. Tree surgery requires considerable knowledge and experience and the operations of unskilled parties often result in more harm than help.

**Oil Paint on Cement**

THERE is some difficulty in making paint adhere to cement, but if the cement is first washed with 1 per cent sulphuric acid (one part concentrated acid to one hundred of water), rinsed and allowed to dry thoroughly, the paint will find the surface suitably prepared for adhesion. Or the cement may be covered with three coats of water glass (silicate of soda), one part to four of water, and then painted. A first coat of linseed oil varnish followed by the usual paint is effective.

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